

Coal Age

AUGUST, 1956

A MCGRAW-HILL PUBLICATION — PRICE 50c

Coal and Competition

A factual analysis of how tough competition is begins on p 54

Up-Hill Continuous Mining

NWI uses continuous miners and shaking conveyors to recover pitching seams. See p 60

Full Contents . . . p 5



**This is a 3,300-ton
raw-coal storage bin...
Details on p 69**



"Talk up" increased
production—greater
safety...with these

M - S - A

.....
COMMUNICATION
.....

SYSTEMS

M-S-A MINEPHONE

Dispatcher sends orders instantly and simultaneously to all motormen with this modern, underground two-way voice communication system. Motormen receive and reply while trips are in motion—keep haulage movements coordinated with production demands. This results in smoother, faster, and more continuous trip movements throughout the mine.

Messages clear tracks for outgoing loaded trips and incoming empties. This system puts an end to traffic tie-ups, errors and accidents; prevents excessive stop-and-start strain on equipment. Write for more detailed information.



• Dispatcher sends orders to motormen . . . routes right-of-way traffic . . . receives reports on positions and station conditions.



• "Jeep" operator requests instructions from dispatcher and maintenance shop for section assignment . . . speeds emergency repair.

M-S-A HOISTPHONE

For accurate, instant response between the hoisting engineer and cage, here's the voice communication system to install. Whatever the job—load leveling—shaft repairs—shaft inspection trips—passenger transportation—the M-S-A Hoist-Phone provides better safety and efficiency through dependable, continuous two-way voice communication at any level, and while the cage is in motion.

Requires no special training . . . simple to use . . . dependable in operation. Write for further information.



• The hoisting engineer is able to control all movements of the cage by communicating with cage rider over the M-S-A HoistPhone.



• Worker uses microphone in cage to tell the hoisting engineer where he wants to go. Loudspeaker mounted on top of cage.



*When you have a safety problem, M-S-A is at your service . . .
our job is to help you*

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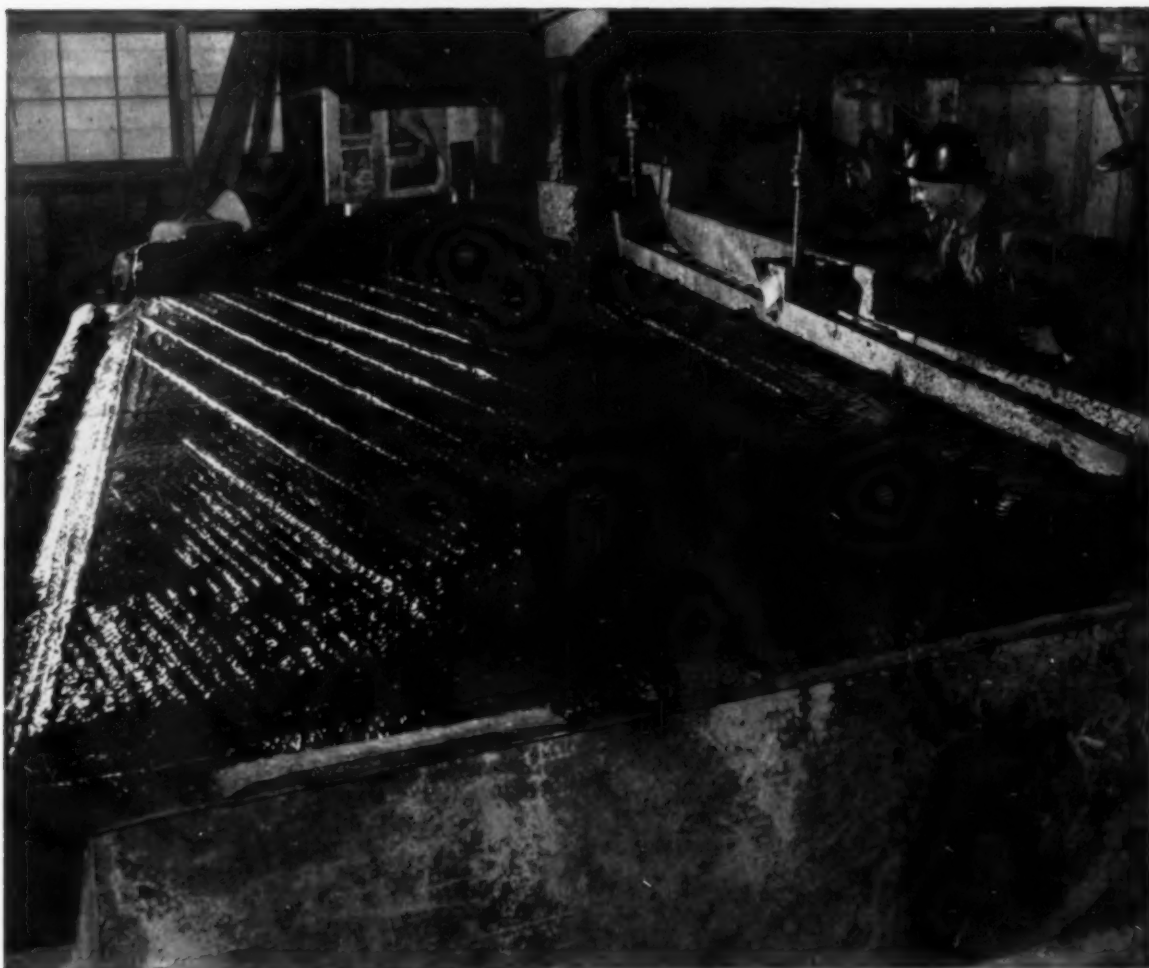
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B.F. Goodrich



Where rubber helps save coal that used to wash away

AT this plant, tons of coal that used to be lost in the washing operation, are now saved on vibrating tables like the one in the picture.

The jiggling table does a fine job of shaking the coal away from the rock. The raised riffles separate the two, so that rock drops off one end of the table, and the coal goes over the side.

Only one trouble. The rough coal and rock wore out every material used to cover the table. Some lasted only two months.

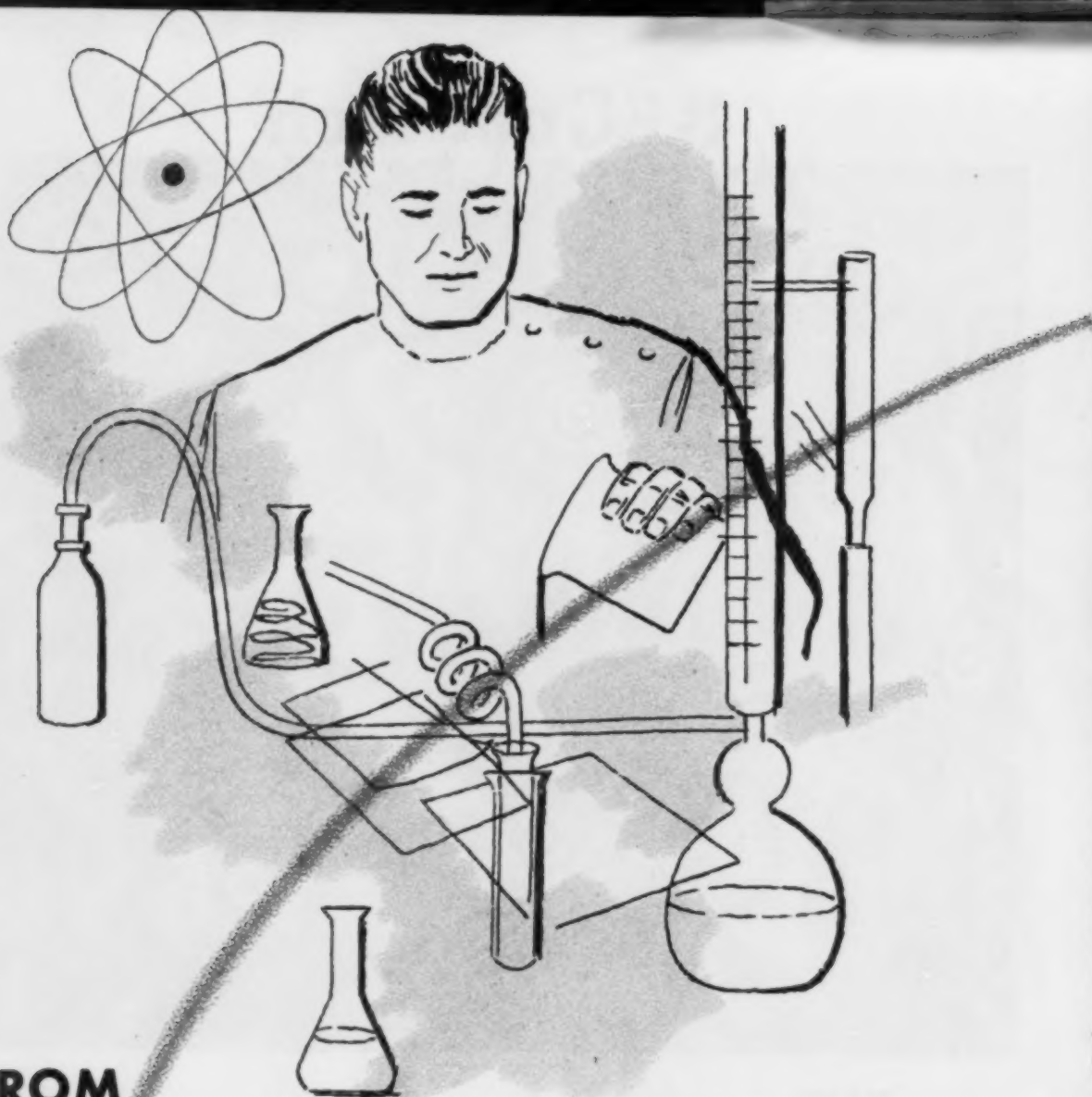
Then a distributor told the plant operators that B. F. Goodrich had a rubber called Armorite, specially com-

pounded to stand this sort of beating. It's so tough that, in many cases, it outlasts the hardest steel 10 to 1. The shaking table was covered with this B. F. Goodrich rubber eight years ago. Since then, over 1½ million tons of coal have been recovered on it. And at last report, it was still in use.

For years, this B. F. Goodrich rubber has been saving maintenance and replacement costs in all kinds of mining operations where handling of abrasives used to wear out other materials in short order. Armorite is ideal for lining chutes, launders, hoppers and pipes and as skirt-board material for

conveyor installations. It's equally good for wet or dry materials. Let a B. F. Goodrich distributor tell you more about this tough, long-lasting rubber. Or, for more information, write B. F. Goodrich Industrial Products Co., Dept. M-709, Akron 18, Ohio.

B.F. Goodrich
INDUSTRIAL PRODUCTS



**FROM
SKILLED SPECIAL . . .
RESEARCH**

**INTENSE CONCENTRATION ON THE
SPECIAL NEEDS OF COAL MINE LUBRICATION**

HAS COME

HULBURT

Red Grease



NON-MELTING • BOILS IN WATER 100 HOURS

HIGHEST SHEAR STABILITY

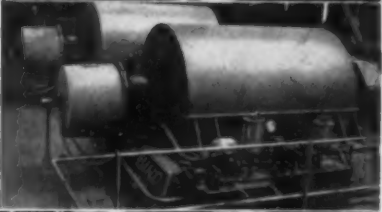
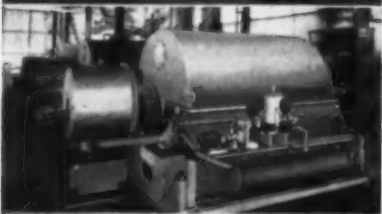
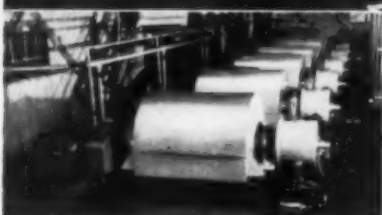
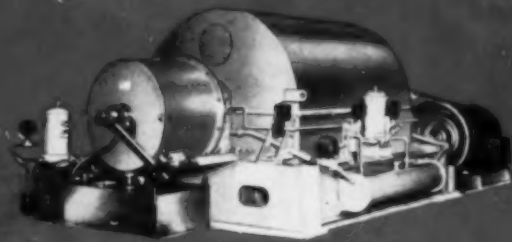
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HULBURT OIL & GREASE COMPANY

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For 40 Years Specialists in Coal Mine Lubrication

THIS BIRD . . . GETS YOUR FINE COAL DRY



Don't pass up the many operating cost-saving advantages of Bird Coal Filters because you think Solid Bowl Centrifugals can't get the coal as dry as you want it.

Handling equivalent feeds these filters are getting the coal as dry as can be obtained by any mechanical means. They handle dilute feeds and the recovery of fines can be controlled.

In addition to minimum moisture content the Bird Coal Filter gives you lowest operating and maintenance cost. It runs continuously for months without repairs or parts replacements. Shutdowns are scheduled.

Bird builds *both* solid bowl and screen machines — is in a position to make unbiased recommendations. Why not get the facts and figures as they apply to *your* fine coal dewatering.

BIRD MACHINE COMPANY
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Regional Offices: Evanston, Ill. • Portland, Oregon

BIRD COAL FILTERS

Coal Age

AUGUST • 1956

In this issue . . .

• Consumption of natural gas and oil, like coal consumption, is hitting new peaks in 1956. This month's lead-off article, beginning on p 54, probes the situation with respect to fuels competition today and tomorrow and what the coal industry must do to increase its total sales.

• An 8-page survey of new types of conveyors for lower-cost coal handling, by Hans von der Recke, describes new horizontal and elevating conveyors now being pioneered abroad which may soon find application in the U. S. See p 77.

• Latest developments in the mechanics and aims of roof bolting, by Ed Thomas of the Bureau of Mines, begins on p 85. Be sure to read this one.

Next month . . .

• In preparation now for next month's issue are a step-by-step procedure for setting up a productive maintenance program and a description of pillar-recovery methods employing small crews operating continuous machines. You may get some supply-handling ideas from the latter article. Also, of course, you'll get fast-reading information on augering, stripping and preparation and a full quota of monthly features.

On our cover

The big radial bin on the cover, designed for raw-coal storage, is fully described in Thomas Fraser's write-up of the Cali plant, p 64.

COAL AGE
VOLUME 61
(with which are combined The Colliery Engineer
and Mines and Minerals)

AUGUST, 1956
NUMBER 8

Published monthly on the 1st, with an additional issue in Mid-July by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Member ABC and ABIP.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Publication Office, 1300 N. 17th St., Philadelphia 23, Pa. Donald C. McGraw, President; Paul Montgomery, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address all correspondence to COAL AGE—Subscription Service, 330 W. 42nd St., New York 36, N. Y.

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Single Copies: U. S. and possessions and Canada: 50c; all other countries, \$1.50.

Subscription rates: United States and possessions and Canada, \$3 for one year, \$4 for two years, \$5 for three years.

Other Western Hemisphere and the Philippines, \$10 for one year, \$16 for two years, \$20 for three years. All other countries, \$18 for one year, \$28 for two years, \$30 for three years.

Entered as second class matter May 4, 1961, at the Post Office, Philadelphia, Pa., under the Act of March 3, 1879. Printed in U.S.A. Contents Copyright 1956 by McGraw-Hill Publishing Co., Inc.—All rights reserved. COAL AGE articles are indexed regularly by Engineering Index, Inc. COAL AGE's own index is published annually in December.

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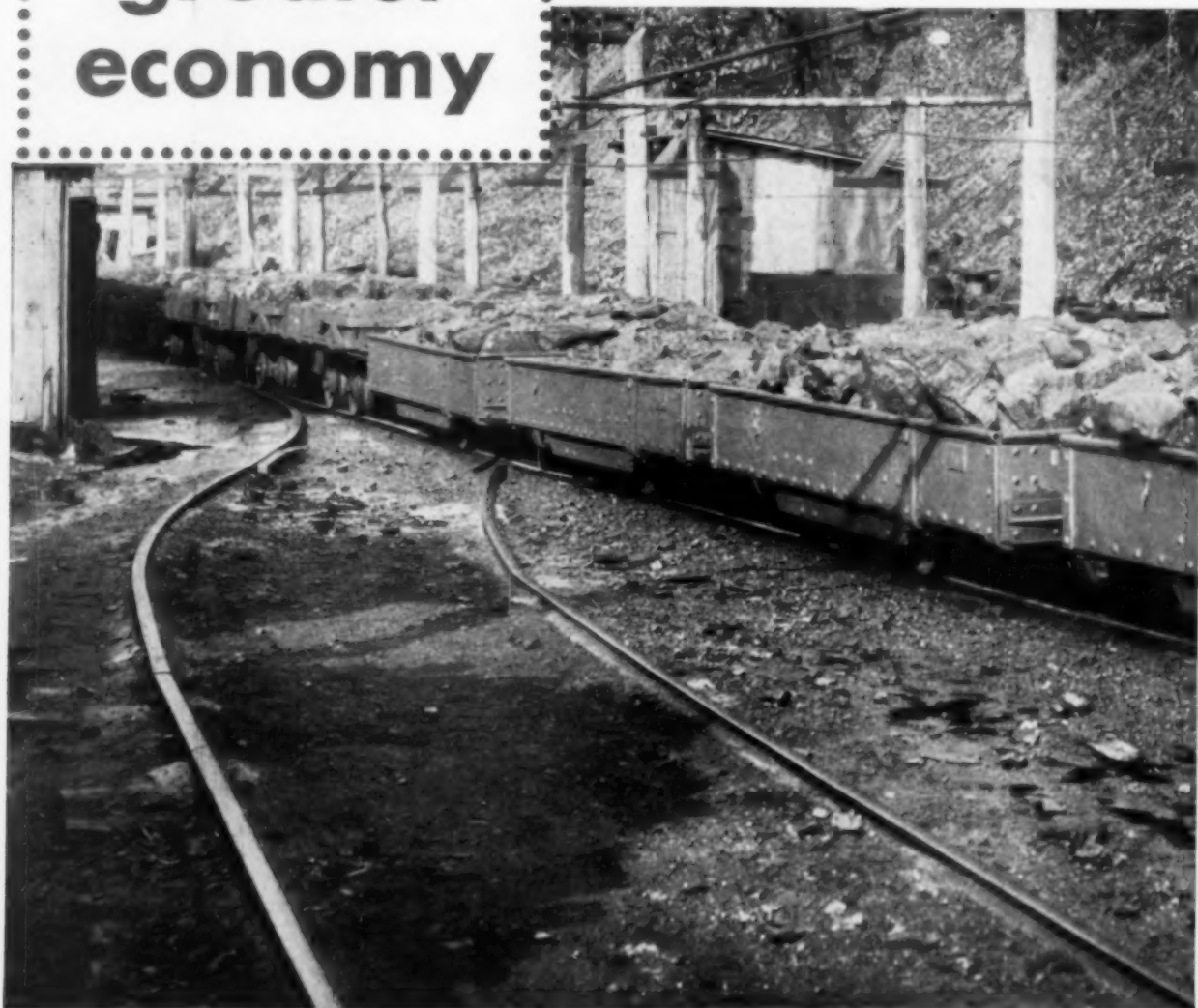
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Texaco Olympian Grease assures smooth, easy starts the year 'round. It *stays in* wheel bearings — gives extra protection against dirt, moisture and wear. Moreover, it has a high oxidation resistance, won't separate



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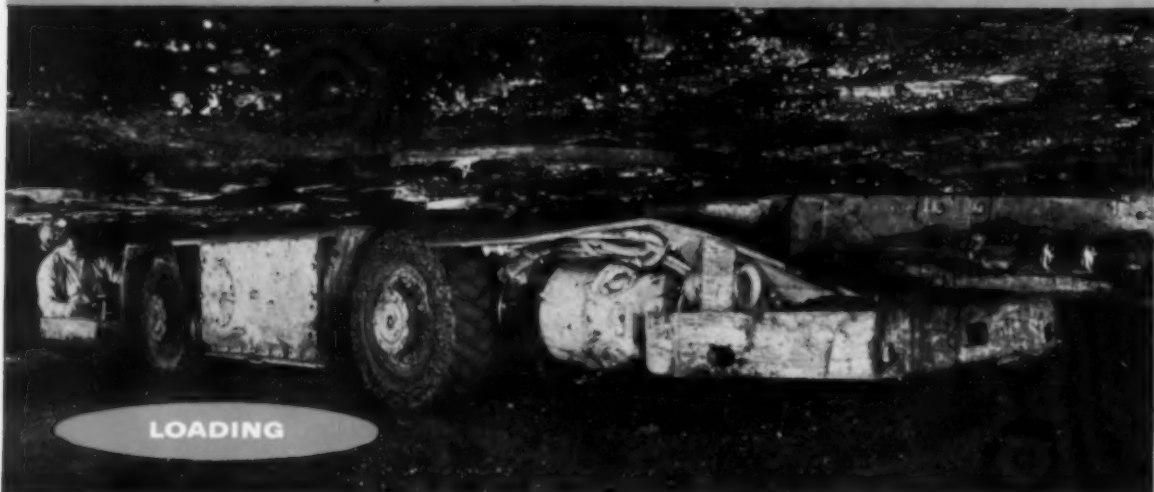
☆ ☆ ☆

The Texas Company, 135 East 42nd Street,
New York 17, N. Y.



LUBRICANTS for the Coal Mining Industry

LOOK HOW WE'VE IMPROVED THE



The Joy 6 SC-7 Shuttle Car has the short turning radius and turning clearance necessary to work in the tightest spots. The tapered bumper and flared rear hopper plates (right) permit fast, easy access to loading boom in low coal, and the manually-operated conveyor clutch permits "feel" of the clutch engagement so the operator has constant check on the adjustment and operation of the conveyor.



6-SC SHUTTLE CAR!

- ★ **HEAVIER WHEEL UNITS!**
- ★ **EASIER STEERING!**
- ★ **POSITIVE DRIVE (NO DIFFERENTIALS)!**
- ★ **MORE RUGGED FRAME—BETTER IN EVERY WAY!**

HUSKY—TO STAY ON THE JOB

Here's Joy's latest answer to heavy-duty, efficient haulage in low seams: the great new 6 SC-7 Shuttle Car! Wheel units are stronger, and the beefed-up frame of the 6 SC-7 has a half-inch thick plate reinforcement at the conveyor hinge section, a boxed-in tapered rear, and a heavier bumper for maximum strength. New induction-hardened worm and worm gear—the latter a steel hub welded to a bronze rim—are 50% stronger than former all-bronze gears.

EASY-TO-STEER MANEUVERABILITY

Four-wheel hydraulically-powered steering makes the 6 SC-7 ideal for sharp turns in close-timbered, narrow headings . . . permits exact positioning of the car under the loader for maximum output and minimum spillage. A new twin-lever type of cam-and-lever steering gear, plus simplified linkage, provide faster-acting power steering and easier handling under all conditions.

POSITIVE POWER

Four-wheel positive traction drive—with no mechanical differentials—provides the balanced "no-spin" tractive effort you especially need on soft or irregular bottoms. Two 7½ HP heavy-duty traction motors and one 7½ HP heavy-duty pump conveyor motor assure reserve power for most requirements. Special 10 HP motors are also available where extra power and faster speeds are desired.

FAST TRAMMING

The 6 SC-7 trams a 2½-ton load (3¼ tons with 4" sideboards) at 3.7 mph, discharges in less than 35 seconds and trams back empty at 4.2 mph. With special 10 HP motors the car trams at 3.9 mph loaded, 4.7 mph empty, and discharges in 29 seconds . . . can make a complete trip from face to discharge point and back again in just a couple minutes.

LOW . . . EFFICIENT TO OPERATE

This new, improved 6 SC-7 is only 29" high without 4" sideboards (other models available in heights up to 38½" without sideboards). Wide operator's platform assures comfort and protection. Low rear, only 15¾", assists loading under low roof, and the discharge conveyor is designed to permit maximum raising. The operator always uses right foot on the brake and left foot on traction.

EASILY MAINTAINED

Drive units, shafts, disc brakes, controls, etc. of the 6 SC-7 are all readily accessible. Wheel drive unit assemblies can be used in any position on the car, reducing stock problems and speeding change-overs. The simplified steering linkage has only half as many parts as formerly. Control switches above operator's platform are out of reach of dirt and water damage, and the front end cable reel mounting and large sheave-wheel guide protect the cable for maximum life.

That's only a part of the benefits built into the great 6 SC-7 Shuttle Car. Let us give you a full rundown on it . . . or any other unit in the complete Joy line of underground mining equipment, built and field-proved to give you the world's best job of cutting costs and increasing tonnage. ● Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

Write for **FREE Bulletin 95-1**



Consult a Joy Engineer

WSW CL 6131-95

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WORLD'S LARGEST MANUFACTURER OF
UNDERGROUND MINING EQUIPMENT



**Your Wickwire Rope distributor
and our steel melter...
always at your service**

This steel melter—at Wickwire's open hearths where wire rope steel is made—is with your Wickwire Rope Distributor every time he makes a call.

True, he's physically at the open hearth compounding steel with the sharp eye of an expert. But your Wickwire Distributor makes his call with the full assurance that the steel in Wickwire Rope has the right chemical content and grain size because it's always produced under rigidly controlled conditions by experts.

It's just one more reason why your Wickwire Rope Distributor knows he's got top-quality rope, slings and strand to sell ... and that these products will serve you well.

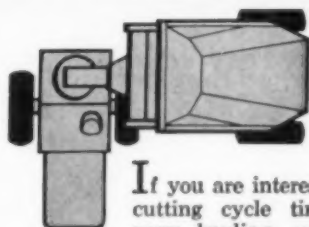


4082

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

90° turns...

give faster cycles
and easier
spotting



If you are interested in cutting cycle time on your hauling, consider Tournapull Rear-Dumps.

These units make a non-stop U-turn by power steer in less than their own length. They eliminate time normally wasted shuttling back and forth to turn in narrow quarters. They also frequently eliminate skid-plates or expense involved in construction of special turn-around areas.

Where space is unlimited, 90° turnability still gives you faster cycles. At the shovel, fast-maneuvering Tournapull Rear-Dump swings in and positions quickly. Loading unit need not sit idle while hauler operator wastes time on a wide sweeping turn and then a long, slow

back-in. Quick, safe spotting saves additional time on the dump.

Simplicity reduces maintenance

A great deal of the expense involved in maintenance is also eliminated because of the simplicity of the Tournapull turn mechanism. Steering involves only an electric motor connected to a ring gear and king-pin shaft. A flick of the finger activates the motor and causes prime-mover to pivot up to 90° around trailing unit. Turns are made quickly regardless of footing. There are no front steering knuckles, no reach rods, no complicated mechanisms to get out of line, maintain, or repair.

Now available with optional tailgate.

Check these and all the other advantages of Tournapull Rear-Dumps. See for yourself how they speed cycles and cut costs. Write or call any time for owner-verified production studies and specifications. There's no obligation.

Model	Capacity	HP	Overall Length	Width req'd. for 180° turn Travel position	Dump position
D	11 tons	138	24'10"	24'8"	18'8"
C	22 tons	208	29'9"	28'8"	20'8"
B	35 tons	293	35'10"	35'	27'

Tournapull Rear-Dump's short turn-radius saves construction of expensive turn arounds. Here, with body raised, "C" easily makes non-stop U-turn in 26 ft. wide area.

These features, too,
can help on your job

Hauls anywhere — Big single low-pressure tires let Rear-Dumps safely travel narrow haul roads, paved highways, city streets... haul cross-country over roughest terrain, through muck and soft fills.

Reduces maintenance — Because these Rear-Dumps have no jack lines, no long drive-shaft, no frame, sub-frame, springs or tie rods, most common troubles of conventional rear-dump haulers are eliminated.

Dumps fast, clean — Flick of switch activates hoist motor. Body lifts quickly to any desired angle for spreading on run. At full dump position, bowl-lip is behind rear wheels so dump can be made clean over bank. Streamlined body sheds material readily.

Cuts weather delays — Power-transfer differential automatically applies power to drive wheel on firmest footing... pulls unit through mud, sand, soft materials which stop ordinary haulers. It's a Tournapull exclusive.

Resists body shock, damage — Three-layer, all-steel, grid-type bowl with tool-steel floor resists loading shocks. Big, wide bowl opening is easy target for any loading unit.

Improves safety — Multi-disc air brakes have more braking surface on one wheel than most haulers have on all 4. Low center of gravity, good visibility, front-wheel drive, easy control all contribute to maximum safety.

Delivers full power — Torque converter (optional in C size) automatically balances load and torque so you get full horsepower always. Lugging is reduced; shocks in transmission and final drive virtually eliminated.

Reduces fatigue — Big low-pressure tires and air-foam cushion seat smooth out ride for operator. Electric push-buttons control power steer and 2-way power dump. Eliminated is all manual work of fighting balky levers.

Insures future earnings — Behind Tournapull prime-mover, you can interchange rear-dump with scraper, bottom-dump, crane, flatbed. These trailing units lower your investment, let you handle any future job efficiently, help you keep your Tournapull profitably busy the year-around.

Tournapull—Trademark Reg. U.S. Pat. Off. R-792-G-b



LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

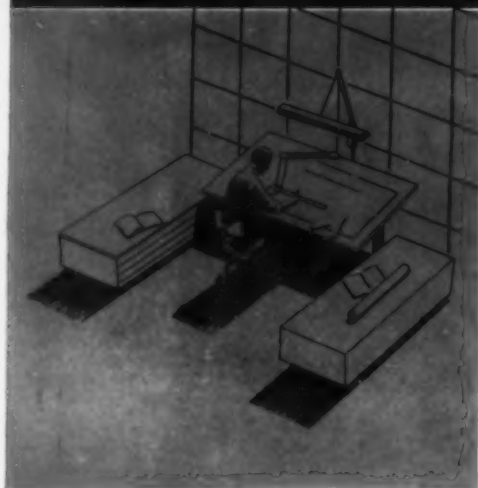
A Subsidiary of Westinghouse Air Brake Company

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Let's see why



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FAIRMONT -built means a Better-Built

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FAIRMONT-built stands for superior planning, tested design, skilled engineering, fabricating and erecting by an organization of specialists backed by more than 60 years experience.

FAIRMONT-built provides independent selection of top-flight equipment best suited for the particular installation and the results expected.

FAIRMONT-built assures uniformity of product plus better than 99% separating efficiency.

FAIRMONT-built means that here is a cleaning plant correctly engineered and properly equipped to meet tomorrow's needs as well as today's.

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DESIGNERS AND CONSTRUCTORS OF COMPLETE COAL

PREPARATION PLANTS USING BOTH WET AND DRY

CLEANING, CENTRIFUGAL AND THERMAL DRYING.

TOURNATRACTOR is a 208 hp tractor that runs on rubber instead of crawling on tracks.

Job records of owners all over the world prove that these tractors-on-rubber outwork crawler-tractors 2 to 1 where job conditions allow the use of higher speed.

With Tournatractor's extra speed and versatility, plus all the other advantages described below, you invest no more, and pay less for operation and maintenance, than for any crawler-tractor of similar power.



Does speed fit your job?

Check these tractor advantages

17 mph forward . . . 8 in reverse

Tournatractor pulls, dozes, pushes at working speeds 2 to 3 times faster than crawler-tractors. You change gears instantly, waste no time shifting, move up to 8 mph in reverse. Torque converter provides the equivalent of an infinite number of gear ratios, automatically selected to balance load and torque.

Drives to work . . . anywhere

Tournatractor travels at speeds to 17 mph from job-to-job. Big, low-pressure tires drive anywhere without need for planking, trailers, loading or unloading.

Simple . . . less maintenance

Lubrication takes less than 5 minutes on Tournatractor, compared to 15 minutes or more on a crawler.

Cleaning of tracks and fittings is eliminated. Self-cleaning tires last 2 to 3 times longer than tracks.

Anti-friction drive

208 hp diesel drives through dirt-sealed anti-friction bearings to free-rolling wheels. There is no grinding wear of sand, dirt, and mud as in driving with multi-part crawlers.

Provides emergency electric power

Flywheel-mounted generator produces electricity to operate blades and PCU, and in emergencies you can tap into this handy electric source for floodlights, power tools.

Easier to operate

Less jolt and jar on low-pressure rubber tires reduces stress and strain on both operator and ma-

chine. Simple electric controls permit operator to work faster, with less end-of-day fatigue.

Improves safety

Low center of gravity, all-around visibility, accessibility, and quick response of electric controls make Tournatractor exceptionally safe to operate. Its multi-disc air brakes have *four times* the braking surface of most big tractors and trucks.

Keeps busy

Stripping overburden, pushing scrapers, cleaning up around shovels, or handling utility jobs, Tournatractor never runs out of work.

Ask your LeTourneau-Westinghouse Distributor to help you analyze specific Tournatractor applications on your stripping operations.

Tournatractor, Angledozer —
Trademark Reg. U.S. Pat. Off. T-941-M-bwww



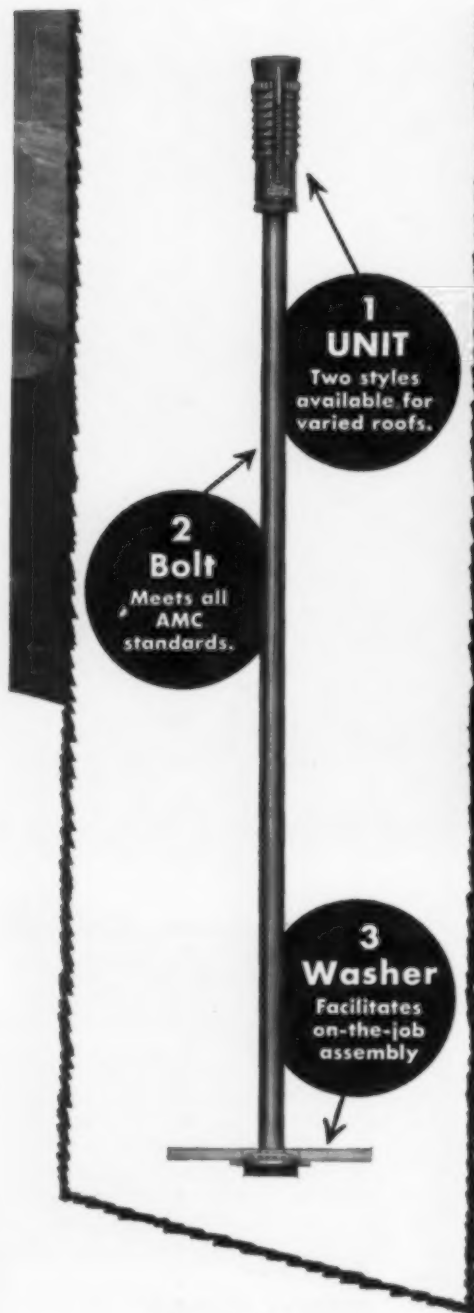
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ARBA



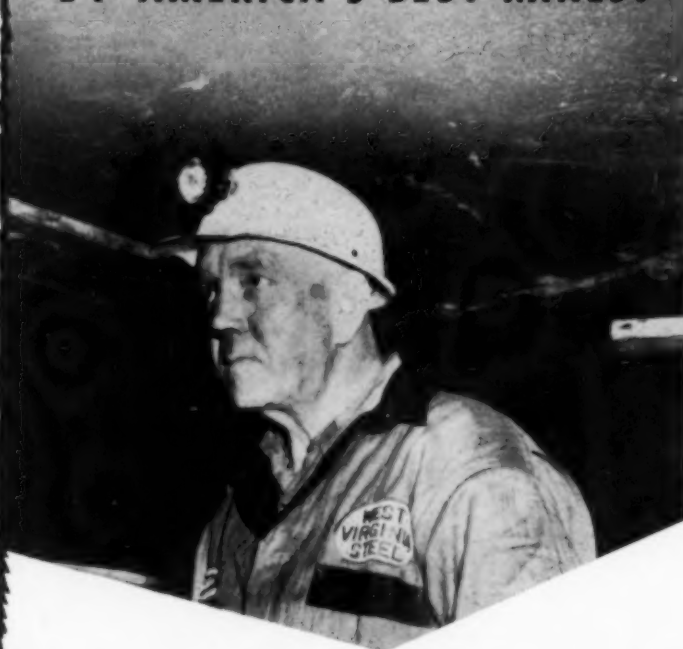
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- GREATER SAFETY
- PROMPT DELIVERY

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BY AMERICA'S BEST MINES!



THE MAN FROM WEST VIRGINIA STEEL

"Ches" Plott, our bolting engineer, specializes in working with difficult roof-bolting conditions. In this capacity, he has worked with personnel in America's leading mines helping them solve irksome problems.

Perhaps you're not one of our valued customers, but if you hit a trouble spot telephone "Ches" collect. He'll be right there—no obligation, of course.

CALL HUNTINGTON 7174 . . . Ask For "CHES"

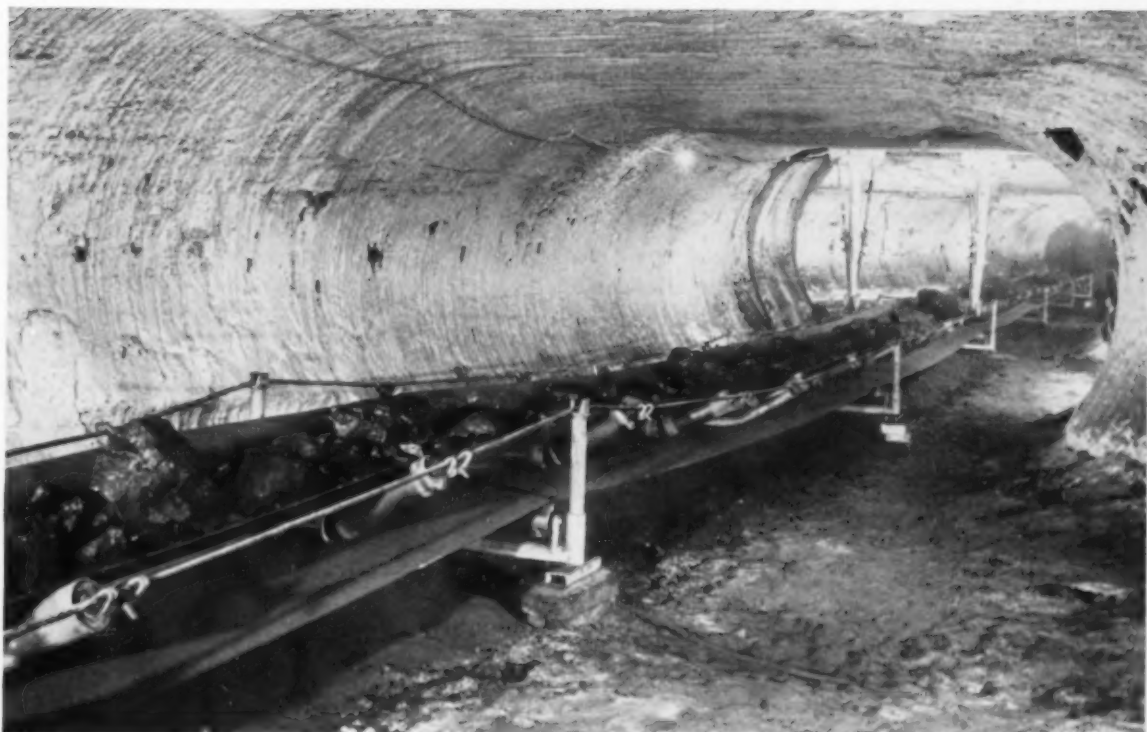
WEST VIRGINIA'S CONE NECK UNIT
PERMITS EASY WASHER INSTALLATION
ON THE JOB.

west virginia steel and mfg. co.

BOX 316

HUNTINGTON, WEST VIRGINIA





21555

Patented and Patents Pending

Why there's almost no spillage with a Goodman *Rope Belt* Conveyor

One of the first things you notice about a Goodman Rope Belt Conveyor is the almost total absence of coal spillage along the line.

Here's why. There is no fixed structural framing . . . no rigid idler assemblies. Instead of side rails, parallel wire ropes carry chain linked idlers over which the belt travels. The whole assembly is flexible . . . resilient. The wire ropes and hinged idlers "give" in accordance with the weight carried. As a result, the load rides smoothly, evenly, with nothing to cause shifting or spilling.

This resilient construction provides other benefits, too. Impact shock is, of course, reduced to a minimum. That means not only longer bearing

life, but smaller diameter rolls can be used and often the belt can be of less ply. The return belt is fully visible and any improper training can be quickly seen and corrected. The carrying belt needs little attention as each linked idler assembly exerts an aligning influence. No training idlers are required along the line.

One of the most important advantages is the ease and speed of installation and extension. Never before has the handling of a belt conveyor been so simple.

Want more details about this time and money saver? Write us today.



Ask for Catalog G-115

This catalog contains full details about the Goodman Rope Belt Conveyor, explains its operating advantages and includes photographs of the equipment in use. Write for your free copy today.

^{* Trade-Mark.}
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MANUFACTURING COMPANY

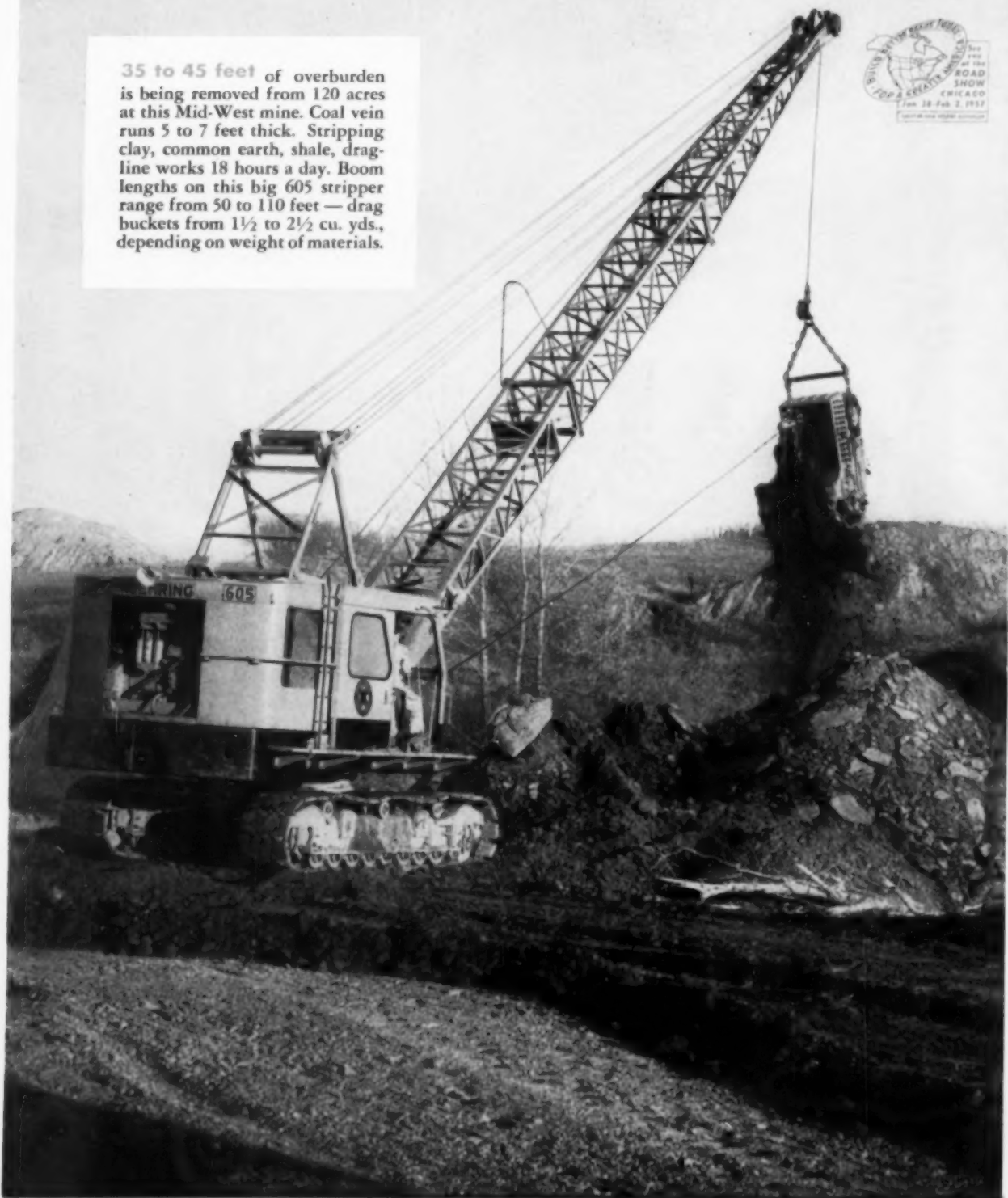
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CUTTING MACHINES • CONVEYORS • LOADERS
SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

Use Genuine Goodman Replacement Parts

KOEHRING WORK CAPACITY *in action . . .*

35 to 45 feet of overburden is being removed from 120 acres at this Mid-West mine. Coal vein runs 5 to 7 feet thick. Stripping clay, common earth, shale, drag-line works 18 hours a day. Boom lengths on this big 605 stripper range from 50 to 110 feet — drag buckets from 1½ to 2½ cu. yds., depending on weight of materials.



KOEHRING COMPANY Milwaukee 16, Wis.

Subsidiaries: JOHNSON
PARSONS • KWIN-MIX



Pan-handler — In an Eastern quarry, slabs of sandstone are palletized on pans for quick pick-up, and loaded on trucks. Pans weigh an average of $3\frac{1}{2}$ tons — an easy lift for the Koehring 205 truck crane. Constantly moving to various piles around the quarry, it easily loads 24 pans an hour, according to quarry foreman. With this mobile 205 crane they are equipped to handle loads up to 15 tons.



At rail siding, 305 clamshell crane speeds transfer of material from gondola cars to trucks. Its fast swing and wide work radius pay off on any material-handling. This heavy-duty 305 is another in a modern, new series of Koehring extra-capacity excavators and cranes. Look them over. They're all listed in accompanying chart.

Meet the 405 — new heavy-duty leader in the 1-yard class. Operators like its ease of control, big power clutch, automatic traction brakes, and simple 2-shaft design of upper machinery. You'll like its big work capacity with all attachments: 1-yard shovel or hoe, 1 to $1\frac{1}{2}$ -yard clam or dragline, 20-ton crane.



Here are some figures that will interest you:

KOEHRING MODEL	SIZE DIPPER	LIFT CAPACITIES	
		(Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load.)	
205 CRAWLER	$\frac{1}{2}$ -Yd.	20,000 lbs.	at 10-foot radius
205 ON RUBBER	$\frac{1}{2}$ -Yd.	30,000 lbs. 13,700 lbs.	at 12-foot radius at 20-foot radius
305 CRAWLER	$\frac{3}{4}$ -Yd.	30,000 lbs.	at 12-foot radius
305 ON RUBBER	$\frac{3}{4}$ -Yd.	50,000 lbs. 15,800 lbs.	at 10-foot radius at 30-foot radius
405 CRAWLER	1-Yd.	40,000 lbs.	at 12-foot radius
605 CRAWLER	$1\frac{1}{2}$ -Yds.	72,300 lbs.	at 12-foot radius
1205 CRAWLER	3-Yds.	190,000 lbs.	at 13-foot radius



Want more information? Call Koehring distributor today.

Change motors in minutes— with **FALK** all-steel **MOTOREDUCERS**



OUT COMES OLD MOTOR ↑



IN GOES REPLACEMENT MOTOR →

No long and costly "down time" involved

Motors can be interchanged or replaced *in minutes* with the all-steel, All-Motor type FALK Motoreducer. No long and costly "down time" is involved in making the change!

Best of all, replacement is not limited to original make of motor—new NEMA frames may be substituted for old. This versatile Motoreducer operates with any make, speed or type of standard foot-mounted motor within its AGMA rating. No modification, no special shaft, no "partial" motor required.

In addition to unmatched motor interchangeability, this dependable gear drive—the "work horse of industry"—offers: widest choice of output-shaft position (horizontal, vertical, right-angle)...any output-shaft connection...any mounting, including wall and ceiling...standard speed range from 1.5 rpm to 1430 rpm. All these advantages, plus proved efficiency, low maintenance and extra-long life, make the All-Motor type FALK Motoreducer your best buy for any job requirement.

Furnished in sizes up to 75 hp with any make, style or type of motor; or, *without a motor if desired*. FALK Motoreducers are available from convenient factory, field or distributor stocks, from coast to coast.

Write for Bulletin 3100

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

MANUFACTURERS OF:

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

FALK

...a good name in industry

FALK "IN-BUILT" FACTORS assure full dependability— better service—longer life



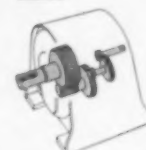
ALL-STEEL HOUSINGS

Rugged, strong, rigid...all parts heavy steel plate, formed and welded in the Falk Weld Shop.



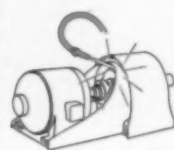
LARGE OVERHUNG LOAD CAPACITY

Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum loads.



PRECISION GEARING

Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion.



SEALED HOUSINGS

Splashproof, dustproof, oiltight. Dual closures and one-way vents keep oil in, dust and moisture out.

MINE POWER FEEDER CABLE

TODAY'S TOP SPECIFICATION FOR MINE POWER DISTRIBUTION

NON-METALLIC ARMORED . . . shielded . . . Roebbling high-voltage Mine Power Feeder Cable is perfectly adapted for practically every sort of power distribution requirement. You can suspend it vertically in shafts or boreholes; run it horizontally in underground entries or suspended from insulators. Since its outer sheath has high resistance to moisture, abrasion and other service hazards,

you can safely bury it direct in shallow trenches.

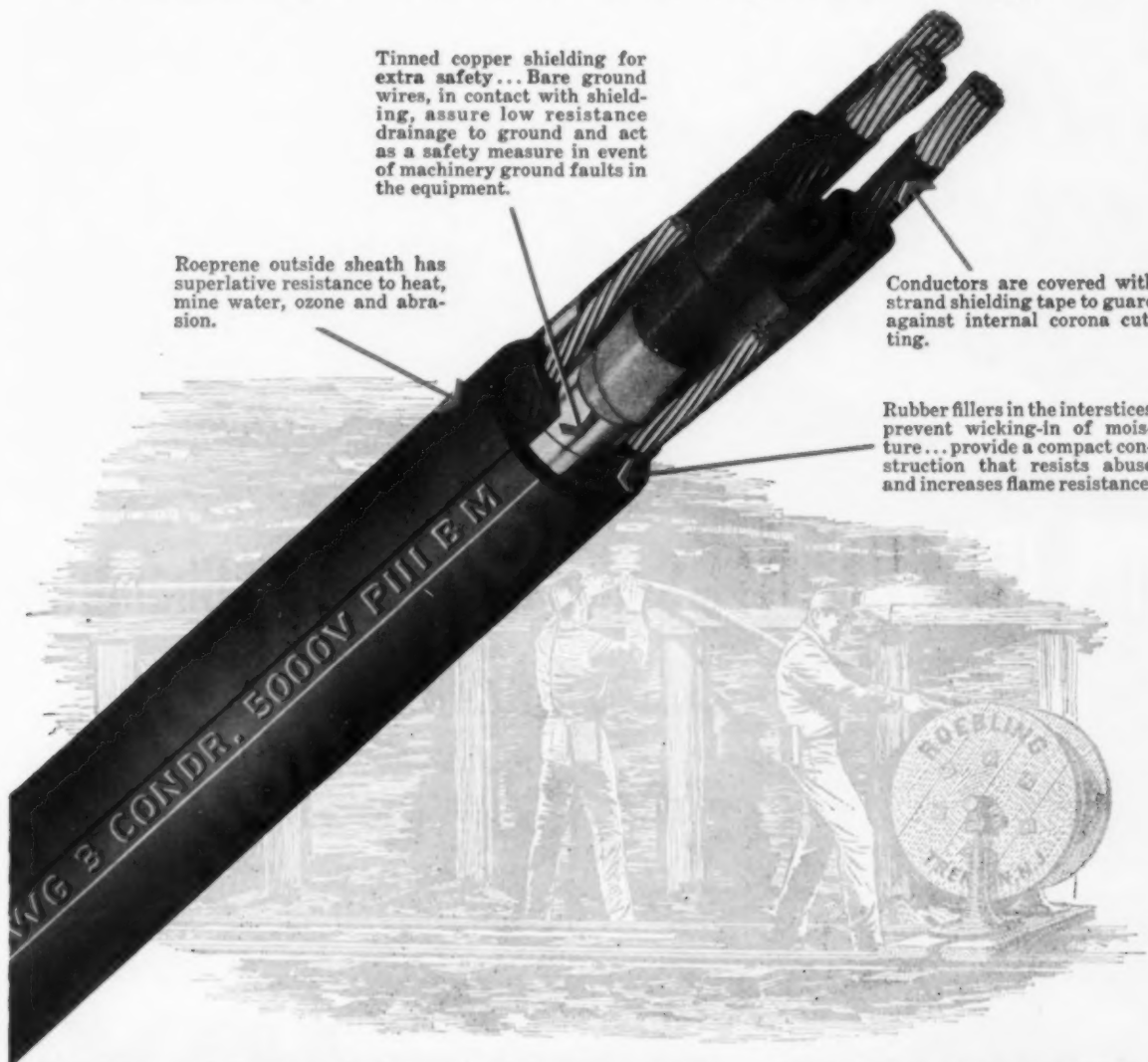
Roebbling Mine Power Feeder Cable has every construction feature that assures maximum safety, dependability and service life. Classified as semi-portable, it is exceptionally easy to move and handle under all conditions. Get complete information on Roebbling Mine Power Feeder Cable from your Roebbling distributor or by writing us.

Tinned copper shielding for extra safety . . . Bare ground wires, in contact with shielding, assure low resistance drainage to ground and act as a safety measure in event of machinery ground faults in the equipment.

Roeprene outside sheath has superlative resistance to heat, mine water, ozone and abrasion.

Conductors are covered with strand shielding tape to guard against internal corona cutting.

Rubber fillers in the interstices prevent wicking-in of moisture . . . provide a compact construction that resists abuse and increases flame resistance.



ROEBBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2340 GLENDALE-MILFORD RD., EVENDALE • CLEVELAND, 12325 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1733 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.



Here's
the drill
you need for
**LARGER,
LOWER-COST
BLASTHOLES**

Joy 60-BH Drill in operation in a large Pennsylvania strip mine.



the **JOY 60-BH** Super Heavyweight Champion

For high-production coal stripping, as illustrated above, large-diameter blastholes are a *must*! The way to drill those large-diameter holes economically—either in coal mining, or in any other open-pit mining or overburden removal job—is with the Joy 60-BH Super Heavyweight Champion. Here's why: because this Joy rotary drill excels in all three of the features which determine bit penetration:

ROTATION—Infinite variation of bit speeds, accurately controlled bit speeds, more power on bit rotation, and constant indication of bit speed and pressure by gauges.

BIT WEIGHT—The Joy hydraulic feed, using two 5-foot hydraulic cylinders, is the most efficient and dependable method of applying bit pressure. It is more accurately controlled and less hazardous than other methods.

CUTTINGS REMOVAL—Only Joy uses a heavy-duty, industrial-type, water-cooled air compressor to insure more dependable air supply required for efficient rotary-air blast drilling.

Other features include a self-aligning hydraulic automatic chuck, hydraulically raised and lowered derrick, and rod handling device.

The 60-BH, capable of drilling 9" to 12" diameter holes in even the hardest rock formations, is the largest in the outstanding line of Joy Champion "rotary-air blast" drills. Smaller models are the 58-BH Heavyweight for 7½" diameter holes, and the 56-BH Middleweight for 6¼" diameter holes. Let us quote on your requirements. Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

Write for FREE Bulletin 116-1



Consult a Joy Engineer

WSW CL 6212-116

JOY

**WORLD'S LARGEST BUILDER OF CORE
DRILLS, ROTARY BLAST HOLE DRILLS
AND MOTORIZED DRILL RIGS**



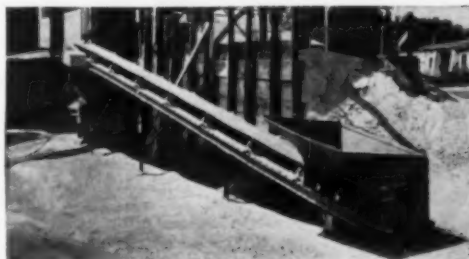
LONG HAUL—Even the longest Barber-Greene Conveyors are built of standardized components . . . produced on a precision, quantity production basis. They can be assembled in almost limitless combinations to cut the time and cost of any material handling job.

Long or short haul—it costs less to move materials with belt conveyors

Thousands of installations—ranging from a few feet to thousands of feet—prove that belt conveyors move bulk material at lowest cost.

No other machine is so simple in construction or requires so little maintenance. No other machine can deliver such high hourly capacities with so little power or attention.

Barber-Greene has given a new meaning to belt conveyor economy. Built of standardized components, Barber-Greene Conveyors are delivered sooner . . . require less engineering . . . are erected faster . . . give top performance . . . and are more easily altered to meet changing or expanding requirements. Being standardized, repair parts are readily available—usually from the stock of your local distributor.



SHORT HAUL—Even the shortest Barber-Greene Conveyors are available in standardized components in the width and length to suit your needs. These small conveyors provide the economical way to handle the widest range of materials with greatest flexibility.

56-7-PE



Send for this 192-page conveyor book. It's comprehensive, easy to use.
Write for Catalog 76-A on your company letterhead.

Barber-Greene

AURORA, ILLINOIS, U.S.A.



CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

COAL AGE • August, 1956

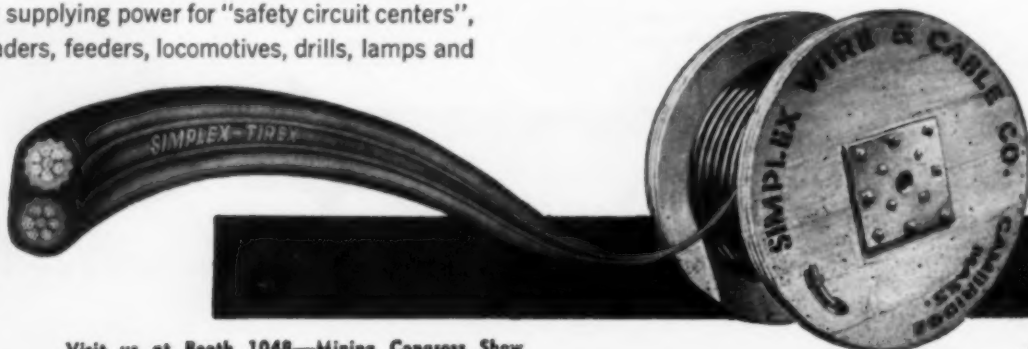
21



Margin for error: None

Mining, because of its very nature, requires "something extra" on the part of both men and equipment. Ruggedness and reliability are especially important, and it is this fact that accounts for the widespread preference for Simplex - TIREX cords and cables. These expertly engineered cords and cables, featuring exclusive CURED-IN-LEAD SELENIUM NEOPRENE ARMOR, are extremely flexible, and resist abrasion, oil and water. They are "on the job" in mines everywhere, dependably and safely supplying power for "safety circuit centers", for loaders, feeders, locomotives, drills, lamps and

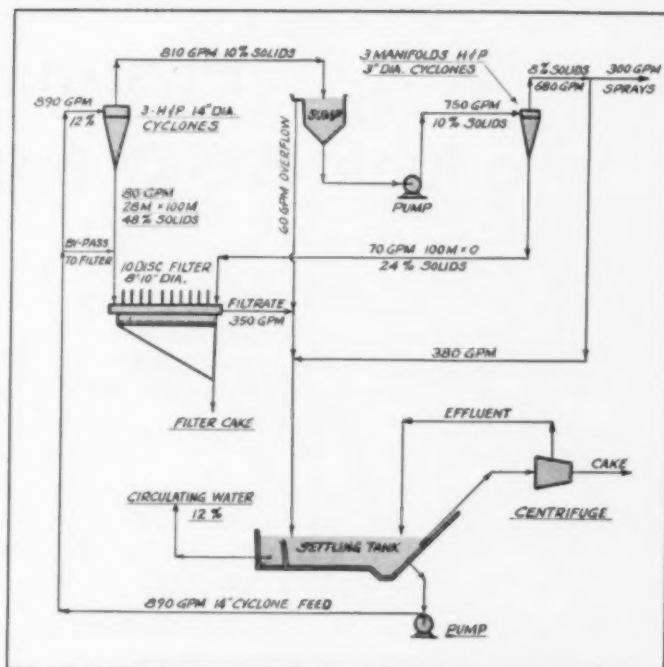
other items of equipment. Simplex-TIREX bears the molded markings of P-101-BM on its jacket, signifying acceptance by the U. S. Bureau of Mines, and approval of the Dept. of Mines, Commonwealth of Pennsylvania. Available in a wide range of sizes, at most mining houses and electrical distributors. Play safe whenever you order cords and cables—specify Simplex-TIREX! **SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.**



Visit us at Booth 1048—Mining Congress Show

Closed Circuit Operation
Recovers Good Salable Coal
from your Bleed,
Stabilizes Washing Density
and Conserves Water

X Company's
Closed Circuit
Does it with
Heyl & Patterson



CYCLONES

For the past 4 years a large West Virginia Coal Washery has been using the illustrated Closed Circuit. It is recovering 20 tph of fine coal while stabilizing the concentration of circulating water at 12%, insuring a quality-controlled product. Naturally, water problems during dry seasons are eliminated.

H & P Cyclones for Closed Circuit operation are a low-cost investment, require minimum space and combine low maintenance with ease of operation.

Utilities, Steel Companies and Coal Operators are presently using Closed Circuits individually engineered by Heyl & Patterson.

We can arrange for you to visit these plants. Find out for yourself how well the equipment operates and how quickly it can be amortized.

CHECK THESE ADVANTAGES!

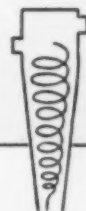
- ☐ Closed circuit operation
- ☐ Recovery of fine coal
- ☐ Prevention of stream pollution
- ☐ Controlled washing water densities
- ☐ Conservation of water
- ☐ Sharp classification for washing operation

Get All The Facts...Write For Booklet CT-954

Heyl & Patterson

INC.

**55 FORT PITT BLVD. • PITTSBURGH 22, PA.
 PHONE COURT 1-0750**



Fast-moving **Jeffrey** produce **550 tons per shift**

AT MINNEHAHA MINE of Fairview Collieries Corporation near Dugger, Indiana, old track-mounted Jeffrey equipment has been replaced with two completely new units of modern Jeffrey apparatus, with highly satisfactory results in production.

Each Jeffrey unit performs the complete mining cycle, and it consists of a roof drill, face drill, cutter, loader and two shuttle cars, with a fifth car held in reserve for use

by either unit.

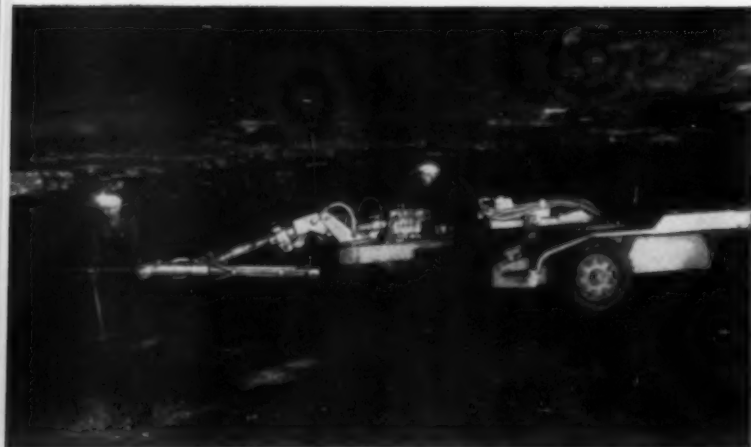
Average output of each unit is 550 tons per shift. Peak tonnages of 800 per shift have been reached. The pictures and captions tell the performance story of the fast-moving Jeffrey machines which constitute each unit.

Find out how this Jeffrey combination can boost *your* production. Call our nearest office. The Jeffrey Manufacturing Company, Columbus 16, Ohio.



*Roof
Drilling*

The 56-RDR Roof Drilling Machines average 125 bolts per shift, with some shifts reaching as high as 170 4-ft bolts. The mine has changed from timbering to roof bolting for increased safety.



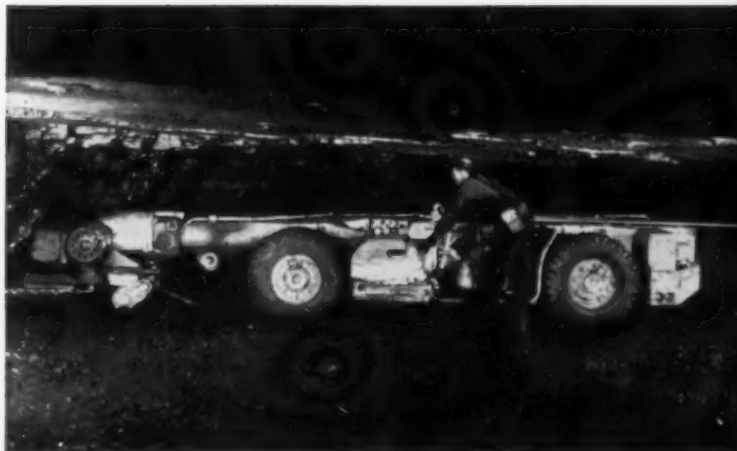
*Face
Drilling*

The 56-FHR Face Drilling Machines provide excellent flexibility, with heads that can be swung by finger tip control for working any-place in the face. Drilling range is 7 ft. 2 3/4 in. vertically and 13 ft. 1 3/4 in. horizontally.

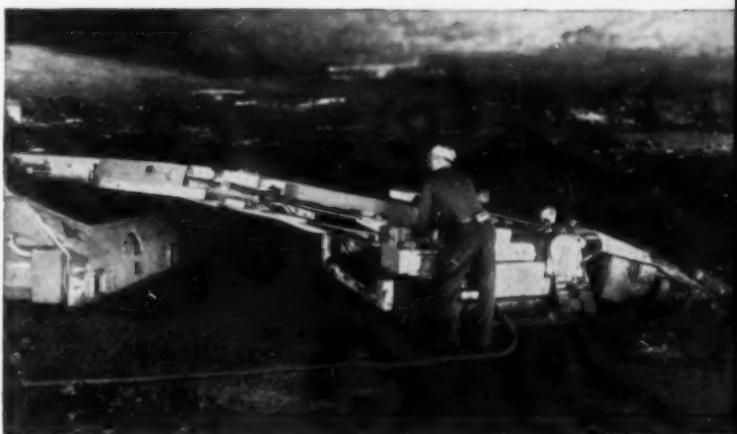
teams for Fairview



The 70-UR Universal Coal Cutters with bug dusters are doing an outstanding under-cutting job at Fairview. Head and cutter bar can be rotated 360° in either direction for any kind of cut, anyplace in the seam. They can make a 30 ft. horizontal cut (using a 9 ft. cutter bar) or a shearing cut 5 ft. 5 in. to either side of center.



Jeffrey 81-A Loaders tram at 137 FPM and can be turned in their own length. The conveyor swings 45° either side of center and elevates to load shuttle cars on the straight or in break-throughs. They are rated at 8 TPM, with maximum of 10 TPM.



Five of these 66-B Shuttle Cars serve the two mining units at Minnehaha Mine. They make fast trips with big payloads from the face direct to mine cars. Features include 4-wheel drive, 4-wheel steering, 4-wheel brakes, hydraulically driven conveyor and cable reel.



• CONTRACT MANUFACTURING





Because of its superior resistance to corrosion Mayari R high-strength, low-alloy steel was selected for the mine sets in the shaft of this iron-ore mine in the East.

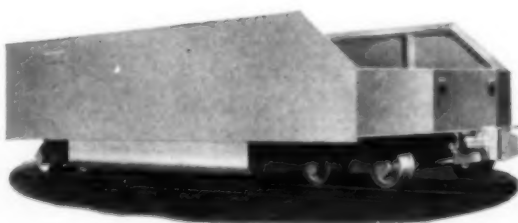
How Mayari R Pays Off in the Mine

Mayari R high-strength, low-alloy steel has a yield point about 50 per cent higher than structural carbon steel. This means that a much stronger structure can be built without adding needless weight or bulk; or weight can be reduced without sacrificing a given strength requirement.

Mayari R resists corrosion far better than carbon steel. And it offers greater resistance to abrasion, battering and piercing—an especially valuable feature in the construction of modern, heavy-duty mine cars.

In the shop, Mayari R can be welded just about as readily as carbon steel, with the same general techniques. It can also be flame-cut, machined, formed and otherwise worked in generally the same manner as plain carbon steel. It has good impact qualities and holds paint exceptionally well.

Catalog 353 contains some 66 pages of technical and illustrative material that should be of help to anyone connected with mine construction or operation. You can get a copy through the Bethlehem district sales office nearest you.



These mine cars, built by Bethlehem, were constructed of Mayari R because of the savings in deadweight made possible by Mayari R's superior strength. Resistance to battering and abrasion also was a factor.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation, Export Distributor; Bethlehem Steel Export Corporation

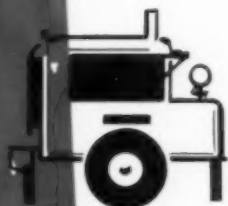
Mayari R ... High-Strength, Corrosion-Resisting Steel



Got a tough job?

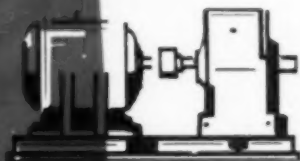
Give it to **STANOIL Industrial Oil**

This oil gives superior lubrication to a long list of mine equipment—here are three big jobs it can do—



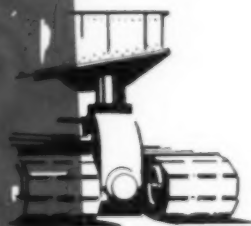
COMPRESSOR

High oxidation stability and low carbon-forming characteristics of STANOIL virtually eliminate the danger of carbon deposits on valves. STANOIL separates readily from water. There is no problem of emulsion in compressor crankcase.



SPEED REDUCER

There are many years between maintenance jobs on speed reducers when STANOIL is the lubricant. Herringbone gears remain clean and free of wear. Low pour point of STANOIL gives oil ability to flow freely from a cold start. No trouble either in prolonged, high temperature operation.



HYDRAULIC JACKS

Tough mine hydraulic service is the ideal place for STANOIL. High viscosity index and low pour point of STANOIL assure smooth operation no matter what the temperature. STANOIL resists contamination, will not emulsify.

Pick your tough lubrication jobs, give them to STANOIL Industrial Oil and get the results you have wanted. Find out more. Call your Standard Oil industrial lubrication specialist. There is one near you in any of the 15 Midwest and Rocky Mountain states. He is experienced in mine lubrication. Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

Quick Facts About STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—Inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm-ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, is resistant to temperature change.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

STANDARD OIL COMPANY
(Indiana)





JIM: "Not interested . . . been using the same flocculant for 19 years!"



PHIL: "I'm always looking for something better, let's give it a try!"*

Which is your reaction to the revolutionary flocculant, SEPARAN 2610?

Oftentimes the solution to a problem is right at hand . . . if we are willing to accept change.

Jim, for instance, was having trouble with stream pollution and high maintenance costs. His coal washer was overloading the thickener. Overflow solids were too high for efficient washing. "I don't care how good Separan 2610® is," he said, when told about this new high-speed Dow flocculant. "I've been using the same flocculant for 19 years and don't intend to change."

Phil, on the other hand, had the same settling and filtration problems as Jim, but waving tradition aside replied, "Let's give Separan 2610 a try!" With only 0.06 pound per ton of fines, Phil cut clarification time from two *hours* to seven *minutes*! Water was conserved! Recycling, clay staining and stream pollution were reduced drastically!

*A sample of Separan 2610 and technical assistance is available by writing THE DOW CHEMICAL COMPANY, Dept. SC 931E-1, Midland, Michigan.

you can depend on DOW CHEMICALS



*Here's why
Euclid Equipment
cuts hauling
costs in open pit
coal mines*



Bottom-Dump Coal Haulers are powered by engines of 200 to 360 h.p.—have 5 and 10 speed transmissions, capacities of 25, 40 and 51 tons and loaded travel speeds up to 40 mph.



Rear-Dump Euclids have rated capacities of 10, 15, 22, 34 and 50 tons—engines of 125 to 600 total h.p., standard 5 and 10 speed transmissions or Torqmatic Drive, spring mounted drive axles, top speeds loaded to 36 mph.

✓ LARGE CAPACITY

Bottom-Dump Euclid Coal Haulers have capacities of 25 to 51 tons. They are available with large single tires or duals on tractor drive and trailer wheels to meet your particular haulage problem.

Rear-Dump "Eucs", ranging from 10 to 50 ton payload are widely used for overburden removal as well as for hauling coal from pit to tipple. There are 5 models—a complete line to meet every coal or waste hauling requirement.

✓ POWER AND SPEED

Depending on model, engines are from 128 to a total of 600 h.p. with 5 and 10 speed standard transmission or Torqmatic Drive that consists of a torque converter with a semi-automatic transmission. Top speeds with full payload range up to 36 mph.

✓ DEPENDABLE PERFORMANCE

Because "Eucs" are designed exclusively for off-the-highway service, they pay off in long life and low maintenance cost. They stay on the toughest jobs longer with less down time for servicing and repairs. Whether they're hauling coal or overburden... on long or short hauls... "Eucs" move more loads at lower cost per ton.

EUCLID DIVISION, General Motors, Cleveland 17, Ohio

For high production and low cost hauling **EUCLIDS ARE YOUR BEST INVESTMENT**



Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE





This mine is set for the future

Here is a modern, heavy-duty haulageway that was built for profitable operation tomorrow as well as today. Here is heavy rail that will stand up under peak traffic loads. Here is tangent track that is really straight; curved track scientifically eased to prevent derailments and spillage.

On this layout, the turnouts and crossings are husky, high-speed designs that keep the trips rolling smoothly. The switch stands and other accessories are sturdy and foolproof. In fact everything about this system is heads-up, right in step with the forward march of coal.

Like it? See possibilities here that might be adapted to the needs of your workings? If so, a Bethlehem engineer is ready to lend a hand. Let him visit your mine to learn all he can about your

problem, then let him come up with a solution.

Once you've approved his plans, he'll take the problem right off your shoulders. All new rail for curved track will arrive at the site formed to proper radii and ready to place in position. All turnouts and other components will have been carefully preassembled to assure perfect fitting. Installation will be quick and easy; wastage, nil.

You'll soon find that the Bethlehem engineer was correct when he told you that such a layout would pay for itself in a hurry. And you'll certainly incur no expense in talking things over with him. He can be reached through the Bethlehem office nearest to you. You set the time and the place.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



• These four Symons V-Screens are installed at Jamison #9 Mine of Consolidation Coal Company (W. Va.) where they are used for dewatering $\frac{3}{8}$ " x 10 mesh bituminous coal.

SYMONS V SCREENS

give users maximum efficiency in FINE COAL PREPARATION

The SYMONS V-SCREEN combines centrifugal force with gravity to do a better screening job—make sharper separations—and give you a much dryer product with less degradation than other dewatering methods. It will reduce surface moisture by at least 50%, even on fine coals... requires only 5 hp to operate under full load... and is the *only* screen that does not depend on gravity alone to size or dewater.

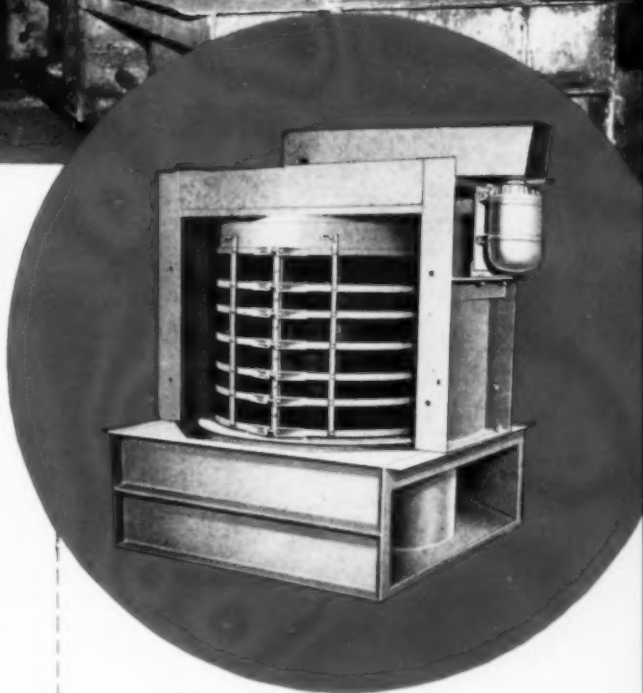
The capacity of the Symons V-Screen is over twice that of a conventional type vibrating screen, per square foot... with average tonnages ranging from 35 to 70 tph per screen. In addition, its new screening principle gives extremely long screen cloth life.

SEND FOR FREE BULLETIN

Write for your copy of Bulletin 243, which gives the full story on Symons V-Screens.



SYMONS... A REGISTERED NORDBERG TRADEMARK
KNOWN THROUGHOUT THE WORLD



FEATURING:

- HIGH CAPACITY
- EXTREMELY ACCURATE SIZING, EVEN IN THE FINER MESHES
- HIGHLY EFFICIENT DEWATERING
- FULLY ENCLOSED — DUSTLESS OPERATION
- EASY REPLACEMENT OF SCREEN CLOTH
- MINIMUM FLOOR SPACE REQUIRED
- LOW COST OPERATION

NORDBERG MFG. CO., Milwaukee, Wisconsin



NORDBERG



MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

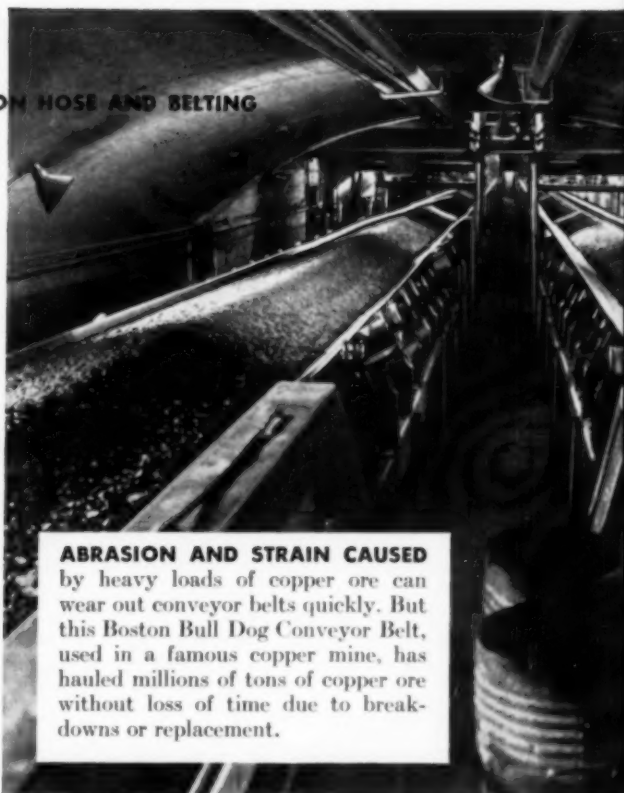
READ WHY SO MANY MINING MEN SPECIFY BOSTON HOSE AND BELTING

How to boost your production and reduce breakdowns at the same time

BREAKDOWNS ON ANY MINING JOB WASTE VALUABLE TIME, skyrocket production costs. That's why so many mine operators, engineers and foremen specify Boston hose and belting. They know Boston products help boost production by eliminating costly breakdowns and adjustments. Even on the very tough jobs, Boston hose and belting turn in performance you can rely on!

WHY SO RELIABLE? There's good reason. Boston specializes in industrial rubber products. *It's not just a sideline.* Boston Woven Hose & Rubber Company has one aim: to continue developing industrial rubber products that will outperform all others on the job.

SPECIALISTS IN GOOD SERVICE, TOO. Immediate delivery is no problem for your Boston Distributor. With his thorough knowledge of mining operations and industrial rubber products, he anticipates your needs, prepares to meet them. Better call your local Boston Man today!



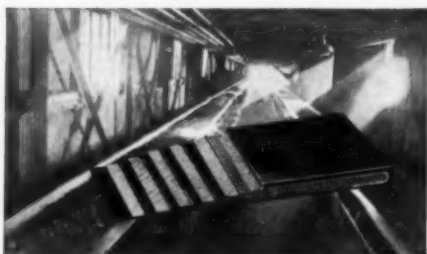
ABRASION AND STRAIN CAUSED by heavy loads of copper ore can wear out conveyor belts quickly. But this Boston Bull Dog Conveyor Belt, used in a famous copper mine, has hauled millions of tons of copper ore without loss of time due to breakdowns or replacement.



BOSTON HIGH-TENSION CONVEYOR BELTING was the important factor in boosting coal production 1500 tons daily in a large Pennsylvania coal mine. Performance has been more than satisfactory, and the low stretch of Boston Conveyor Belting reduces costly maintenance time for take-up and repair.

INDUSTRIAL HOSE • FIRE HOSE • BELTING • V-BELTS • PACKING

BOSTON CHECKLIST FOR YOUR HOSE AND BELTING REQUIREMENTS



BOSTON HIGH-TENSION BELTS: Cut your operating costs on long center and high lift conveyors with Boston High-Tension Belts. They need fewer, lighter plies to carry heavy loads. Boston's Rotocure process makes this possible by eliminating mechanical distortions and uneven stretch.



BOSTON CUSTOM CONVEYOR BELTS: On special applications, Boston's know-how teams up with Boston's Rotocure process for job-right performance. One specially engineered Boston belt, used by a large iron mine on the Mesabi Range, lasted five times longer than competitive belts!



BOSTON CONVEYOR BELTS: Specific job engineering for length of haul and type of load means Boston belts give you outstanding performance on every job. One Boston Silver King Belt still serves a major coal company in Virginia after 20 years (the original drive wore out after 15 years).



BOSTON TRANSMISSION AND V-BELTS: You get increased operating efficiency wherever you use Boston Transmission and V-Belts because they are specially designed to eliminate slippage, require fewer adjustments. That means fewer breakdowns, less wear and tear on motors.

BOSTON HOSE: Your Boston Man has a complete line of air hose, water hose, face hose and rock-dusting hose designed and engineered by Boston to give you superior performance, even on the tough jobs. His experience will help you pick the right hose for every application.

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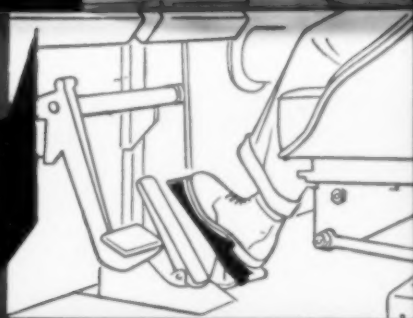
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MATting • TAPE

PUSH THIS PEDAL...



Payhauler® Bonus-



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This new Model 95 Payhauler is carrying 24 tons of shovel-loaded limestone over the quarry floor, up the ramp to the crusher. A 4-speed torque converter transmission provides smooth speed changes and gives direct-drive performance through a lock-up clutch design. The Model 95 is also available with a 9 speed conventional transmission.

Try load-highballing turbo-charged diesel power in either the new 24-ton Model 95, or 18-ton Model 65 International Payhauler—with highest hp-per-ton of any similar-size off-highway trucks. Turbo-charging keeps cargo-power high, engine weight per hp low, cuts fuel costs 10%, or more—reduces upkeep.

Try the big-load-handling advantages of heat-defying, smooth-applying International Cerametallic clutch facings. No other clutch in any off-highway hauler gives such power-transfer efficiency, operating ease, or long life.

Try Payhauler "load-cradling", speed-gaining de-

sign! Semi-elliptic, multiple-leaf, free-floating springs swallow the "rock-shock" of big-shovel loading—and the mauling of 36 or 38 mph speeds. And brawny Payhaulers have the strongest main frames known of any off-highway haulers.

Try picture-window vision, ahead and to sides. Offset cab gives clear back-up view. Try changing speeds by *power-shifting*—steer with *power-steering*—dump with fast, responsive *power-hoisting*. You ride in "spring-hydraulic" cushioned seat comfort—fuel-up once daily! Try new Payhauler job efficiency! Have your International distributor give you a demonstration today!

Try new International[®] Powered performance

Try it..

Try a new Dirt-Heaping, Bid-Beating International Payscraper[®]. Overburden comes off fast when there's a high speed International Payscraper doing the stripping. A twenty-yard load takes less than a minute for the Model 75 Payscraper shown here with an International TD-24 push tractor. Compare payload-boosting Payscraper production to any other two- or four-wheel unit. See your International Construction Equipment Distributor for a demonstration today!



Try it..

Try new Bonus-Powered International crawler advantages! Try seconds-fast, true *in-seat* International gasoline conversion diesel starting—now standard equipment in all crawler models. Size-up the advantages of "control-tower" job vision—new booster steering ease—new Cerametallic clutching ease and efficiency—new 480-hour lube oil filters. Prove how bonus-powered performance boosts production, simplifies servicing! Try one, on your job.



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ON YOUR
JOB!**

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Jan. 28 - Feb. 2, 1957



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How are NEOPRENE BELTS at carrying coal?

THE Coal Convention in Cincinnati in May was an occasion for much discussion of neoprene conveyor belts. Everyone accepts the fact that neoprene belts are fire-resistant—but a question frequently asked is: *How are they at carrying coal?*

OPERATING CHARACTERISTICS

You'll see no difference in operating characteristics between a good neoprene belt and a conventional belt of the same high quality. In cold weather, neoprene belting runs as smoothly as conventional belting. It requires no more drive power or belt tension. It gives about the same friction on the drive pulley. On slope conveyors, coal has no greater tendency to slide back down a neoprene belt than it would on a conventional belt . . . but you'd probably find that a neoprene belt stands up better through years of service.

SERVICE LIFE

Neoprene's resistance to deterioration means longer life. As time passed, you'd see that neoprene's superior resistance to softening when oil gets on the belt . . . and to cracking from exposure to sunlight and weather . . . results in longer cover life and continued protection for the fabric against acid water, mold and mildew.

If you're not already familiar with neoprene, you can easily check its performance in your own mine. Neoprene covers are used on your trailing cable and on most of the hydraulic hose on your mining machines. If your processing plant carries oiled coal by conveyor, the belting used is almost certainly neoprene.

WHO MAKES NEOPRENE BELTS?

Neoprene is a synthetic rubber made by Du Pont and was first introduced in 1932. It is sold to rubber companies who make it into finished products.

The same rubber companies that supply your conventional underground belting have been making neoprene belts for many years. Both types are made on the same equipment and in the same constructions. They are plied up and vulcanized the same way. These rubber companies *know* how to make neoprene belts of the top quality you expect. They have no new art to learn . . . you have no "growing pains" to live through.

You can benefit by the new standards of efficiency and safety offered by underground neoprene conveyor belts. We'll be glad to tell you more about neoprene's properties. Just write: E. I. du Pont de Nemours & Co. (Inc.), Elastomers Division, Wilmington 98, Delaware.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



Pennsylvania Mine Reports...

Long Piggyback System helps boost average tons per face man by 250%



The LONG Mobile Conveyor Drive permits moving the conveyor head, pictured above discharging coal into a LONG Gathering Conveyor, from one location to another under its own power.

The Piggyback Conveyor, shown at right, provides continuous transportation from the face to the outside because it eliminates lost time for car changes.



At this Pennsylvania mine, LONG Piggyback* and Mobile Room Conveyors are being used to service two continuous mining machines in a seam that varies from 34-inch to 42-inch in height. Average production has been boosted 250% per face man per shift, and face advance has been stepped up from 5 to 90 feet per shift.

In commenting on his company's experience with the Piggyback Conveyor System, Mr. Charles Richardson, superintendent at this mine, says, "Our LONG equipment has practically eliminated spillage and supplies an uninterrupted, steady stream of coal to the processing plant. We feel that this continuous

haulage system, in combination with efficient overall planning, and the use of continuous mining machines, has been largely responsible for helping us change this operation from a non-profitable one to the point where it is making money."

Results like this are typical with low-investment, low-maintenance Piggyback Mining—whether used with conventional loaders or with continuous mining machines. In case after case, this unique system has meant far more tons per man, much lower operating costs, and greatly increased profits. We'll be glad to supply facts and figures.

*Trade Mark

For complete details or a demonstration, write...

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new TS-260



power-

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for production

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to capacity With more than 18 horsepower for every yard of struck capacity, the new TS-260 has plenty of power to move full loads at full speed—under all conditions.

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to strength The TS-260 has the structural strength and balance to effectively utilize all of its horsepower . . . with extra capacity built into the clutch, transmission, final drives and drive axles . . . with a heavy, all-steel, box-type tractor frame . . . and with proper over-all weight distribution.

Motor Scraper



200 hp
11 yd (struck)
14 yd (heaped)

and profit on the job!

power-matched for speed The big Allis-Chalmers diesel engine provides high torque at both high and low engine speeds resulting in smooth shifting and fast acceleration. And with plenty of engine power, the TS-260 loads fast, hauls fast, dumps fast... moves big payloads at low cost, even under tough conditions.

power-matched for operating ease Overlapping gear speeds in all four gear ratios reduce gear shifting, speed work cycles. And with 90-degree steering for rapid maneuvering in close quarters, it's easy for the operator to get the most out of the TS-260.

*The new TS-260 gives you these four basic advantages...
and many important new features*

CHECK IT FROM EVERY ANGLE—



the New **TS-260** *is* **Designed for Low-Cost Dirt**

"Live action" hydraulics for sure control. Positive gear-driven pump provides constant live power for both steering and scraper operation. Full-flow filtering, cross relief valves and simple design make this an efficient, safe performer.

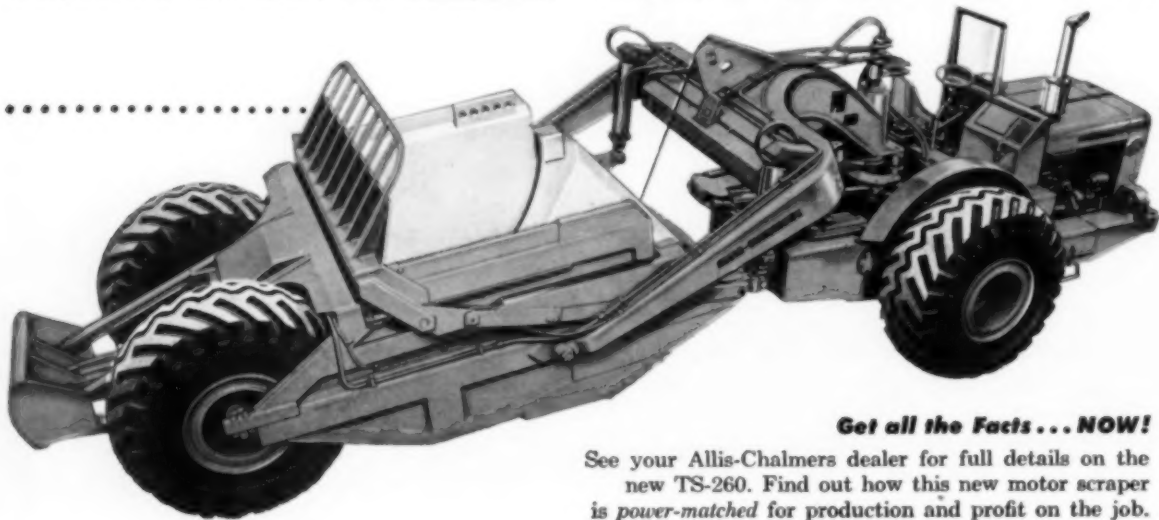
Positive 90-degree steering for close-quarter maneuverability. The steering wheel is direct-link connected to the steering valve. A 30-degree turn of steering wheel directs full pump flow to two double-acting steering jacks for fast, positive turns up to 90 degrees. For slower turning at high speeds, a slight turn of steering wheel provides a smooth, regulated response.

Double-safety brakes for positive stops. Big, four-wheel air brakes provide sure braking under full load at full speed . . . and an air reservoir system with emergency relay valve means positive braking safety.

"Boiling-action" loading for big payloads. Combination of curved bowl bottom and offset cutting edge provides a "boiling" action that eliminates voids . . . builds profitable, heaped loads.

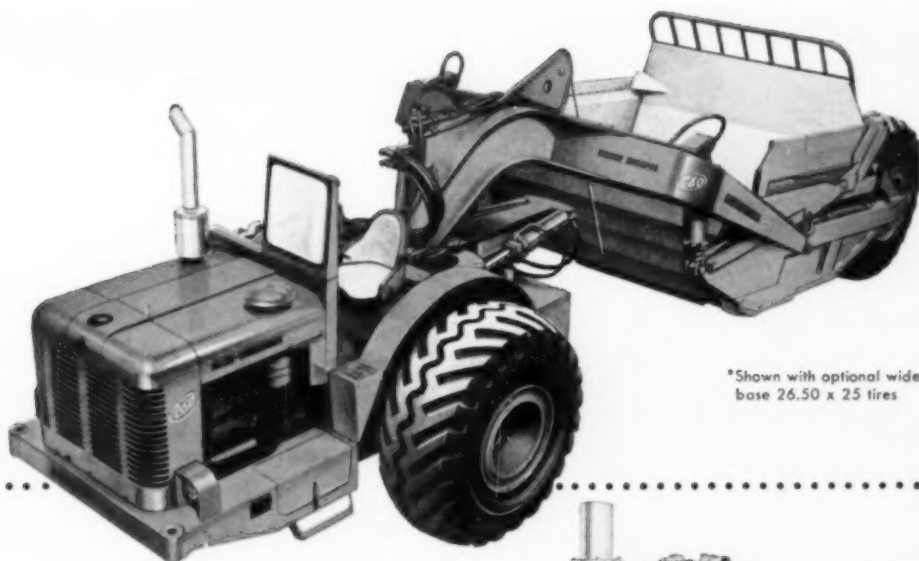
Quick, clean spreading with high apron and forced ejection. Patented linkage moves apron ahead and up when ejector goes forward . . . providing high apron lift and exceptionally large opening for clean, easy-to-control unloading.

Balanced weight distribution for maximum traction, long tire life. When empty, 66 percent of entire TS-260 weight is on front wheels—34 percent on rear wheels. When loaded, each wheel supports equal weight—providing excellent flotation and fast hauling.



Get all the Facts . . . NOW!

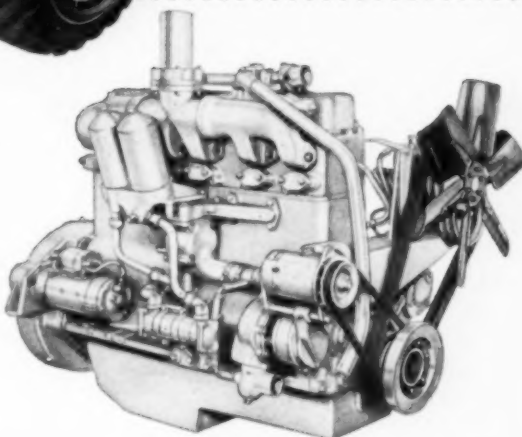
See your Allis-Chalmers dealer for full details on the new TS-260. Find out how this new motor scraper is power-matched for production and profit on the job.



Choice of tires to fit job conditions*. Standard 21.00 x 25 (20-ply) or optional wide base 26.50 x 25 (20-ply) tires provide a choice that insures carrying capacity and full flotation for steady going in all types of material.

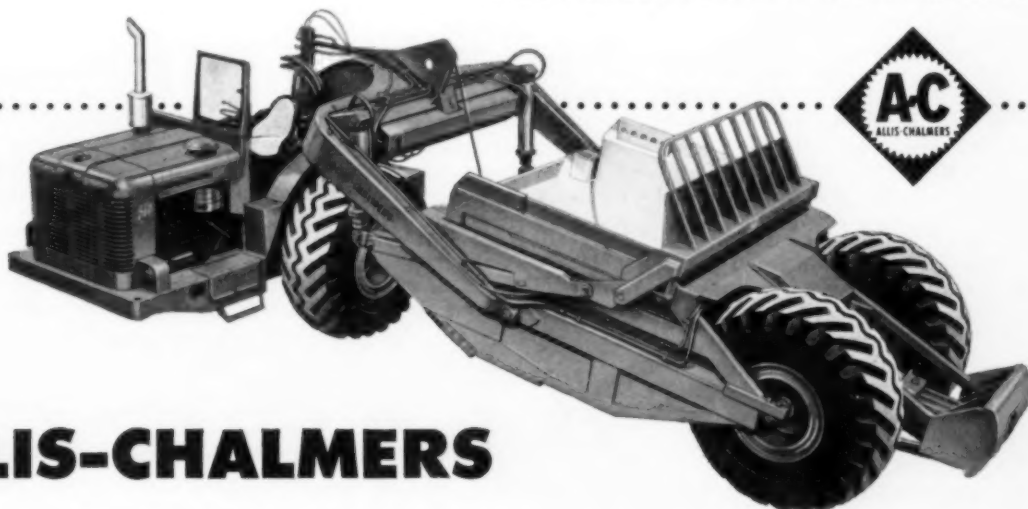
Big 200-horsepower Allis-Chalmers diesel engine. The 844-cubic-inch piston displacement and conservative 200-horsepower rating of this outstanding diesel engine provides plenty of reserve for low-cost operation under all conditions. "Follow-through" combustion results in sustained power, low peak pressures . . . smooth, steady performance.

New easy-shifting transmission. There's a correct gear ratio in the TS-260 transmission for every speed, every work condition. New clutch brake and gear overlap in all four speeds makes it easy to shift gears smoothly, maintain steady acceleration and full pulling power.



Heavy-duty power train. The TS-260 power train is designed to transmit high engine torque to the drive wheels with maximum efficiency. The engine, clutch and constant-mesh transmission are assembled as a unit to assure accurate alignment. Simplified removal of each individual component provides easy serviceability.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN



ALLIS-CHALMERS



STUMPED by high track replacement costs?

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When the going is extra tough, as in rocky areas or abrasive mineral soils . . . tractor shoe replacement can become a major cost item. Both repair time and down time eat up profits.

Switch to "the toughest steel known" . . . **Amsco Manganese Steel** . . . for tracks and grouser bars. Check their much longer service life against the moderate extra cost. Add to this the greater

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Amsco Manganese Steel gives excellent resistance to abrasion accompanied by impact . . . actually *work-hardens* in use. Write for full information on long-wearing **Amsco Manganese Steel Tractor Shoes**—the economical answer to high track-replacement costs.



COUNTER-SUNK BOLT HOLES

Amsco Track Shoes have holes counter-sunk for less wear on bolts. Saves cost of replacing bolts when changing shoes.

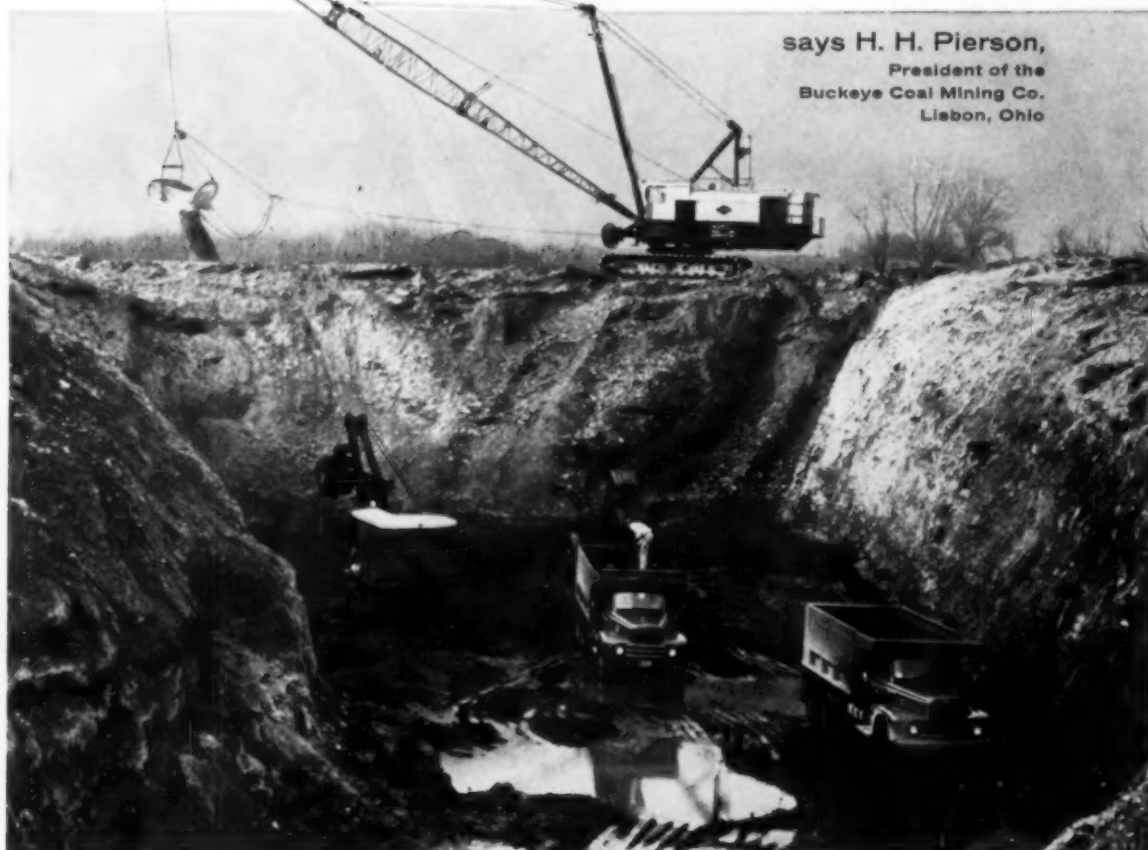


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"GULF DIESELECT FUEL *gives us smoother engine performance and greater economy,"*

says H. H. Pierson,
President of the
Buckeye Coal Mining Co.
Lisbon, Ohio



"Gulf Dieselect Fuel gives us quick engine starting in our heavy equipment, even in sub-zero temperatures," says Mr. Pierson. "We also appreciate the smoother engine performance and greater power, which we attribute to the clean-burning qualities of Gulf Dieselect. It helps us reduce maintenance costs."

Every day more strip mine operators like the Buckeye Coal Mining Company are switching to Gulf Dieselect Fuel. They're discovering it's the best fuel choice they can make for their diesel engines. Here are some of its outstanding advantages:

● 100% straight run distillate ● Clean burning—does not form harmful deposits in tanks, filters, and injectors ● High volatility ● High cetane

index ● Low end point ● Minimum smoke

Because it is so clean burning, Gulf Dieselect helps prevent fouling of oil control rings and reduces ring sticking. And because of its high volatility, it vaporizes quickly and burns evenly, completely, so you can be sure of cleaner valves.

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Just think! Complete control of dig, hoist, swing and propel of these giants with simple stepless control. 12% faster cycles; 16% savings in operating time. *This is Electronic Control.* Exclusive with P & H.

For complete information, call your P & H representative. Electric Shovel Division, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

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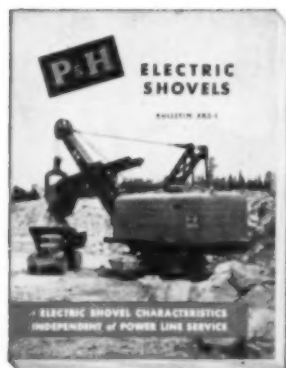
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ELECTRIC SHOVEL DIVISION

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CONTROLS give operators electric shovels



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**T. M. of Harnischfeger Corp. for Electro Magnetic Type Coupling*

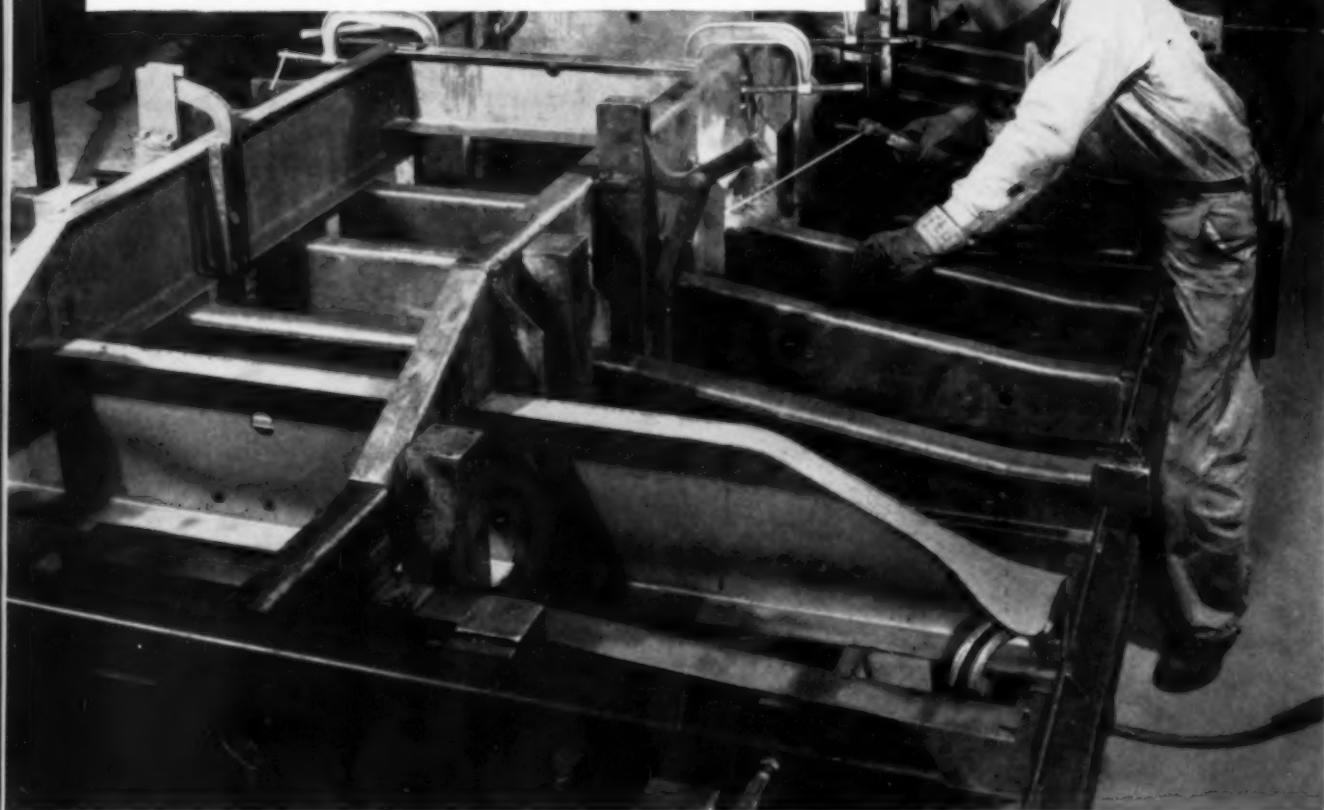
CORPORATION *Milwaukee 46, Wisconsin*



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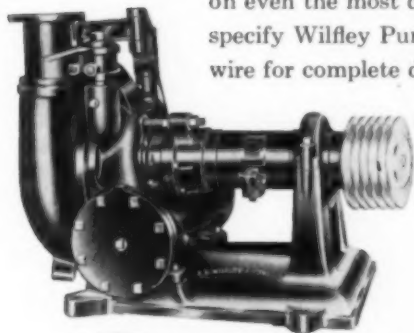


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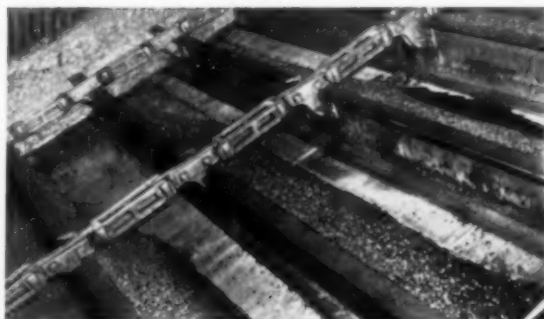
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A 25-foot blanket of overburden is being rolled back rapidly and profitably by this Marion 111-M, swinging a 4 yard bucket on a 100-foot boom. Electric swing on a diesel machine, big self-cleaning crawlers and other Marion features make a difference you should know about before you buy another machine in the 4-yard class.

MARION POWER SHOVEL CO.—MARION, OHIO



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Republic, alone, is able to supply all four major classifications of roof bolt assemblies. This complete line versatility lets you select the assembly best suited to your overhead strata conditions for maximum bolted roof security. That's one reason why an increasing number of mine operators are specifying Republic for all of their roof bolting needs.

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bolt, the conventional bolt with expansion sleeve shell, the square head bolt with wedge nut and rigid expansion shell, and the exclusive forged wedge head bolt with rigid expansion shell.

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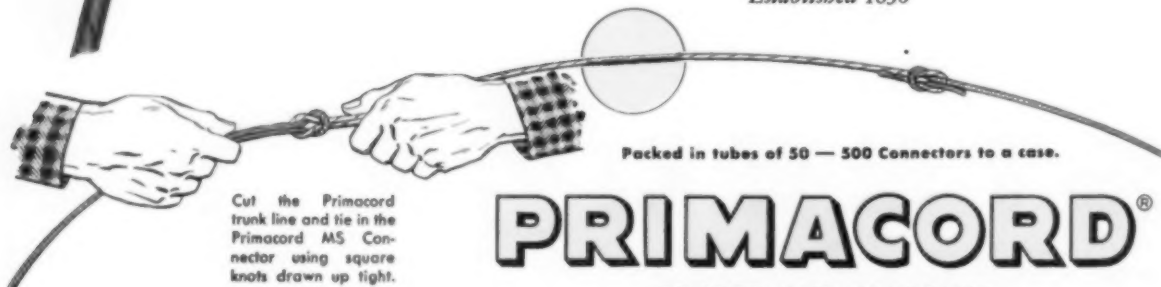
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Cut the Primacord trunk line and tie in the Primacord MS Connector using square knots drawn up tight.

Packed in tubes of 50 — 500 Connectors to a case.

PRIMACORD®

**PROVED AND APPROVED
DETONATING FUSE**

P-20



AUGUST, 1956

IVAN A. GIVEN, EDITOR

Not Automatic

"THE FUTURE? Good, but not automatic. We will gain in markets and cost improvement in proportion to the time and thought we give to improving both sales and operating methods, and the money we devote to research development." Thus one coal man replied to one question asked by *Coal Age* in a study of industry planning for the years ahead to 1960. That question was: "What is your personal opinion of the coal industry's future?" Since the reply summed up so neatly the basic coal situation, it was natural to lead off this discussion of planning and planning problems with it.

First, however, a full report on the future plans of the coal industry will lead off the September issue of *Coal Age*. Meantime, a sneak preview shows the following: a very high level of capital expenditure and a lot of new mines in the next five years; also, as might be expected, major activity in the installation of new mining and preparation equipment. The goals? One is higher quality of product. Another is a lower-cost product, the latter to be attained by an increase in efficiency. Again, a sneak preview shows that industry executives expect an increase in tons per man in the next five years equal to or greater than in the past five, or more than one-third in tons per man per day.

But this increase, as noted, will not be automatic. The level of planned expenditures is one indication that a real effort will be required. Even with this outlay, major problems remain to be solved and needs to be met. Machine capacity and efficiency were cited by

a big majority of those commenting as leading in these categories. A lesser but still impressive group pointed out that there is an especial need for better or new equipment for the thinner seams, especially continuous miners.

Service looms larger and larger in executive thinking as a result of wider installation of new high-capacity equipment. The need for better mine transportation, at the face and elsewhere, was perhaps the most frequently cited need of all. Scarcely less frequent in mention was the need for better maintenance and the elimination of breakdowns. Other service needs were noted as well, some frequently, but transportation and maintenance are seen as remaining critical for some years to come, with the result that they will continue to demand a heavy share of management and supervisory attention.

When all else is said and done, however, manpower remains the vital ingredient—trained, enthusiastic and enterprising manpower, that is. This is clearly recognized by the industry leaders responding to the *Coal Age* survey, and they properly note the need for higher quality all along the line, as well as the need for greater proficiency in the art of getting things done. One road to these goals is training. Finally, registering the conviction that the future outlook is good, these industry leaders close the circle. In other words, they make it clear that men and management, properly trained and fully conscious of their responsibilities, have an even better opportunity to grow and prosper with a dynamic industry that is on the uptrend.



How Tough Is Competition?

GOING INTO THE HOME STRETCH in '56, coal holds a firm lead, or is gaining advantage, in most markets, where it is competitive with other fuels.

In the utility market, still top dog and edging further ahead of gas and oil, coal's main job is to hold prices down, continue research and improve customer service.

The battle with oil and gas in the retail and industrial markets is tough and will continue tough in the immediate years ahead. But the big boost in '56 shipments to both outlets shows this prospect: an added fighting punch in merchandising equipment and engineering aid might turn the tide more strongly in coal's favor.

Competition is not significant in either steel or export but each market, beset with growth problems, bears close watching for full development.

Diesels, of course, continue to take the lion's

share of the railroad business, relegating coal to an "also-ran" position—at least for a time. However, the coal-fired gas turbine locomotive, within the next 5 to 10 yr, stands a better than fair chance of recovering a major share of this market for coal.

Taking a quick look at long-range competition and opportunities, note particularly that:

1. Coal has little to fear from nuclear power. The Nation's energy needs are expected to rise to such magnitude that atomic power will most likely supplement rather than compete with coal power.

2. Coal is a near-sure bet to find large tonnage use for direct conversion into chemicals, gas, and oil as supplies of natural gaseous and liquid hydrocarbons become scarce.

In more detail, competitive trends, sales opportunities and market needs line up as follows (also see briefing p 56):

Electric Utilities

Competition Now—Minor and declining in practically all territory normally considered accessible to coal. Exceptions are the Rocky Mountain area and the Far Northwest.

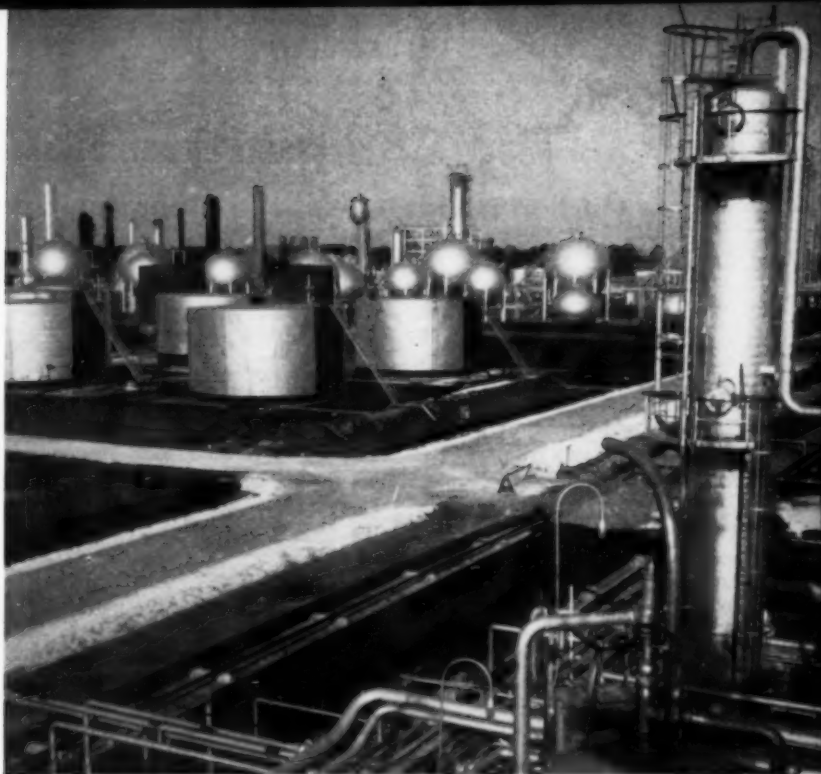
Competition Tomorrow—Minor in

coal territory, with additional opportunities opening up in hitherto non-coal areas—Florida, Texas and California, as examples. Atomic power still only a possibility a decade or more in the future—and even then not a probability unless government subsidy provides an advantage.

Coal use by electric utilities in 1956 is moving toward a new peak of 158 million tons, up 12% over 1955. The forecast is based on a coal burn of 65 million tons by utilities during the first 5 mo of 1956. It allows for some slowdown in general industrial activity during the third quarter and

NATURAL GAS AND OIL are moving to new consumption peaks in 1956, despite rising prices and talk of dwindling reserves. Are they still as troublesome to coal as in the past? Will they be less trouble—or more—in the future?

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Assistant Editor, COAL AGE



assumes a fourth quarter at least as good as the first two. The forecast is also based on an increasingly favorable competitive situation defined by John W. Evers, president, Commonwealth & Edison Co. before the NCA convention in June, as follows:

"Competing fuels are becoming more costly, and, in the case of gas, less available for boiler fuel. Coal is abundant and operators have done a fine job of holding down coal prices. If these trends continue, coal is certain to get a bigger and bigger share of the fuel orders from our power companies.

"Both oil and gas prices have been rising. With exploration and production costs edging still higher, the upward price trend in all likelihood will continue . . . If present trends continue, oil and gas may both be priced out of the electric energy market."

FPC figures support Mr. Evers' analysis. For the 12-mo period ending April 30, 1956, these show that utilities burn 22.7% more coal but only 8% more oil and 0.1% more gas than in the 12 mo period ending April 30, 1955.

Mr. Evers added that "hydroelectric facilities will account for a decreasing portion of our total power requirements. This has been in evidence for the past 15 yr. It should be accelerated in the years ahead."

Nothing new has entered the atomic power picture to change the *Coal Age* forecast of January, 1956 (p 54) that:

1. If the country's electric power needs are to be met in 1975, annual coal use for power by that time must climb to 430 million tons, or three times 1955 usage.

2. Atomic energy may never be competitive with coal and other fossil fuels because the country's energy needs beyond 1975 are expected to rise to such magnitude that there will be (a) more energy tasks than fuel supplies, and (b) greater use specialization and mutual dependence among fuels.

Although coal has a highly favored position in the electric power market, Mr. Evers cautioned the industry not to "just sit back and wait for orders to pour in. It will have to work for them. It will have to pay more attention to servicing its customers—to making good on its representations with respect to Btu values, shipments, type and quality of coal. It will have to continue its programs of research, modernization and mechanization to hold down costs and prices. This (effort) must include a continuous guard against rising transportation costs which, in recent years, have all but nullified the success of the coal industry's own efforts."

The utilities head also urged coal to reinforce its fine record in the past few years for continuity of production. "A guarantee of steady coal supplies could lift a heavy financial burden from the shoulders of power companies." Large reserves must now

be maintained to guard against possible interruptions in supply such as occurred prior to Korea because of labor difficulties both at the mines and on the railroads.

Steel and Chemicals

Competition Now—None from other fossil fuels in the steel, foundry and smelting industries; tough from petroleum and natural gas in many segments of the chemical field. For that relatively small tonnage of coke still sold as home, commercial or industrial fuel, the competition is the same as with coal—tough in the home market and less difficult though still tough in the others. The same applies to the also relatively small tonnage of both coal and coke used to make gas.

Competition Tomorrow—Since there is no known substitute for coke in smelting iron ore, coke will grow with the steel industry in the future, though the rate per ton of pig will be cut by higher efficiency in the future. Coal in the form of coke also will be used for pelletizing taconite, sintering of ore, and for the extraction of other metals from their ores—some old and some new.

Coal as coal or after charring or coking has a good chance of getting back into the gas market to augment the natural supply or take over in areas where cost rises make the natural product too expensive. Coal also has

The Competitive Roundup . . .

Market Trends . . . Sales Opportunities . . . Market Needs

Utility—Still climbing, gaining over gas and oil, but no sinecure. Needed: better customer service, continued research, cheaper transportation.

Steel and Chemicals—Steady in '56. Growth and changes ahead. Note steel's drive to record low coke rate over next 10 yr (*Coal Age*, May, 1956, p 54). Watch opportunities in process steam. Needed: more sales, technical and market research.

Industrial—A good bet to become second biggest outlet in '56. Ripe for sales push. Competition weakening. Needed: harder-hitting merchandising and engineering aid, more market data.

Retail—Bottom hit, bouncing back. Still tough-going ahead with gas, oil may level off. Needed:

stepped-up effort to sell story of modern equipment, more market data. Watch electric space heating and gasification of coal.

Export—Shipments high, rising. American Coal Shipping, Inc., props permanency. Ocean freight costs down but biggest job still ahead. Needed: wider industry backing of ACS; action to provide more ships, improve port facilities, guarantee quality coal.

Railroad—Down slightly again but future promising. BCR's locomotive nears production model stage. Early cost data shows savings over diesel operation. Needed: positive view, broader thinking on long-range prospects; push on BCR locomotive and electrification.

the possibility of serving as the raw material for liquid-fuel production, but the prospects are definitely long-term. Meantime, however, charring or coking will grow as a basis for chemical production.

Operating at near capacity, steel output was running at an annual rate of 126 million tons by the end of June, 1956. However, most industry analysts—weighing the effects of the summer strike and the expected slowdown in third-quarter steel demand—figure that by the year's end the total will match but not beat 1955's record production of 117 million tons. The upshot: coke ovens in 1956 should use 114 million tons of coal (the same amount as in 1955) to supply the needs of the steel, gas and chemical industries.

Although steel will suffer some setback in 1956, the industry is gearing for expansion unprecedented in its history. During the next 3 yr, steel companies have announced plans to increase present capacity (128 million tons) by 15 million tons. Over the next 15 yr, estimates indicate that new capacity should average 4 million tons a year or total 60 million tons.

The projected 60-million ton jump in steel output capacity will undoubtedly bring a considerable increase in the demand for coking coals. But coal management should take serious note of this fact: the increase in demand for coking coals will not parallel the increase in pig iron production, as has been the historic pattern. An integral part of steel's long range expansion program will be a strong push

toward a record low coke rate. In other words, for every ton of pig iron produced today, blast furnace operators need an average of 1,750 lb of coke. During the next 10 yr, steel men anticipate that the coke rate will drop to 1,300 lb at the most efficient furnaces. It will probably average out across the industry at 1,500 lb (*Coal Age*, May, 1956, p 55).

The decline in the coke rate—slower in the immediate years ahead—will pick up momentum in 1959. By that time, planned techniques for boosting blast furnace output up to 25% (*Coal Age*, May, 1956, pp 56-59) should start to show real gains.

The steel industry's drive for fuel economy and gains in blast furnace output points to an urgent need for:

1. Keeping abreast of the carbonizing requirements of the steel industry. More intensive, continuing sales and technical research is indicated. In particular, watch the trends to lower grade and blended coking coals, sintering and pelletizing.

2. Investigating the prospects of converting steam-raising coals into briquettes or other forms suitable for direct use in the blast furnace. One of the largest bituminous producers has already reported progress on the development of such a tailor-made blast furnace fuel.

3. Re-evaluating domestic and export markets for metallurgical coals. This doesn't mean selling domestic customers short. But a major dip in the steel industry's coke rate might open the way to supply greater quantities of coking coals to the fast-grow-

ing permanent, overseas market.

4. Checking new or growing market opportunities in steel. By 1980, for example, the annual production of taconite pellets is expected to reach 40 million tons. Power for processing this output will require more than 1.5 million tons of bituminous coal.

"Process steam consumption is another item that seems to be growing," Charles R. Hook, chairman, Armco Steel Corp., told the NCA Convention in June, 1956. "The coal industry can gain a lot of ground here where it is competitive with other fuels. Armco's Middletown plant has doubled its process steam consumption within the last 5 yr." Mr. Hook also pointed to the tremendous growth in steel's power requirements:

"In 1955, the industry consumed 34,838,000,000 kwhr of electricity—a record year. The proposed 15-million ton increase in steelmaking capacity (over the next 3 yr) will boost the industry's power needs by more than 11%, adding another 3 billion kwhr to the total load."

The phenomenal growth of the chemical industry is expected to continue in the years ahead. And this means a sustained demand for coke chemicals. But coal management should keep a close eye on the direct production of chemicals from coal, which offers still greater potentials. Speaking on the subject at the June NCA Convention, Dr. Joseph Davidson, vice president, Union Carbide & Carbon Corp., said:

"It will probably be another year or so before we can finally run up the

flag again (on commercial hydrogenation of coal), but I think by that time we will be able to do it." The minimum-size hydrogenation plant should process 1,000 tpd of coal; the maximum size may handle 3,000 to 6,000 tpd, Mr. Davidson indicated.

Processes for the conversion of coal to gas and oil have been developed and proven technically feasible. As a matter of fact, the world's first large-scale synthetic-oil-from-coal plant was opened in South Africa early last year (*Coal Age*, September, 1955, p 54). Conversion processes will be used commercially in this country and involve large tonnages of coal—perhaps within 25 yr—if and when the depletion of oil and gas supplies makes such use economically attractive. Discussing gas from coal, E. S. Pettyjohn, vice president and director, Institute of Gas Technology, said (*Coal Age*, March, 1955, p 55):

"The development of economic coal-conversion processes will not only give us an additional supply of low-cost gas immediately but, since the reserves of coal are many times those of oil and gas, will insure an unlimited gas supply."

Also in the chemicals picture, is Pitt Conso's low-temperature carbonization process reported ready for commercial use last year. As development on this process advances, coal carbonization plants are expected to form the basis of expansion in chemical refining operations and open a new, large tonnage market for coal.

Industrial

Competition Now—Tough to mild, depending on type, size and location of industry. One of the toughest areas is represented by consumers that can use the so-called packaged boiler. These include smaller industrial plants and such commercial establishments as greenhouses and laundries.

Competition Tomorrow—Definite trend toward easing as a result of higher competition fuel prices. Process can be accelerated by more engineering merchandising and service, and increased effort on the development of modern coal- and ash-handling equipment, including packaged units.

Last year the biggest surprise in market growth was export. This year it could easily be the industrial market. Sales to this group soared to 49.1 million tons during the first 5 mo of 1956 (including 3.9 million tons to cement mills). At this pace, 23% ahead of the corresponding 1955 period, the group had nearly overtaken the steel market. By year's end,

the group seems a good bet to become coal's second most important outlet.

The fast pace in the growth of the industrial market during the first 5 mo of 1956 is due partly to an 11% jump in use by cement mills. But, most of the boost stems from the miscellaneous group, "other industrials," which makes up about 91% of shipments to industrial plants other than steel and electric power.

Coal should have smooth sailing ahead in the cement market. Competition is slight here since coal is usually preferred to other fuels in making cement. Further, the boom in construction activity shows no signs of slowing down. If anything, as the new \$33 billion Federal highway construction program gets into operation, it will be a major factor in sustaining and boosting the boom.

Where coal has its toughest problem and, at the same time, one of its biggest opportunities is in planning sales to the great mystery group of plants making up "other industrials." The problem is tough because there has never been any breakdown on shipments to this group. It has, however, long since passed the position of being a polygot category to which the industry should give only a casual nod.

Individual producers have picked up their miscellaneous industrial customers over the years because most of these customers have virtually knocked on the back door. As a result, the individual producer's knowledge of "other industrials" is confined to his own list of customers which more or less fit into this category. He has no way of knowing the components of the group for the industry at large. And he has little or no basis for setting up a comprehensive campaign to expand sales to this major coal market. Here's what it all adds up to:

Individual producers and the industry at large should make an all-out attack to dispel the mysteries of "other industrials." High on the agenda should be industry-wide backing of NCA's effort to get the USBM to provide more adequate statistical data on bituminous shipments (*Coal Age*, July, 1956, p 145), and to the development of accurate knowledge of just who the possible consumers are, where they are located, and what they can use in coal, equipment and service.

No less important, companies should see to it that salesmen team up more closely with fuel engineers and trade associations to sell the technical and economic merits of modern coal-burning equipment (*Coal Age*, June, 1956, p 138). In many cases, well-timed engineering aid can prevent conver-

sions from, or effect conversions to coal. Too many plants base estimates of coal fuel costs on antiquated equipment.

The time for developing "other industrials" could hardly be riper. The rapid growth in the total for the group fairly screams its unexplored opportunities and potentials. Also, evidence mounts here that the fabric of competition from gas and oil is weakening. The NCA Market Promotion Department, for example, receives more and more reports from various parts of the country that oil-fired package boilers are failing to do a good job:

"I will never get a packaged oil-fired unit again," said a plant manager to Joseph Mullan, manager of NCA's region No. 2 (based in Gloucester, N. J.). "We have now bought a conventional water-tube boiler to replace the existing package unit." Although this unit (a 300 hp oil-fired package unit burning No. 6 oil) is only one year old, it had numerous shutdowns due to tube failures.

Reports have come in from many other areas about trouble with heavy fuel oil on packaged oil-fired boilers. William D. Robinson, manager, region No. 2 (based in Paterson, N. J.), has noticed frequent difficulties in oil-fired plants in his area. An engineer in Washington, D. C., reports heavy deposits in the furnace tube at the point where the flame impinges on the metal. Harold Mays, manager, region No. 12 (based in Salt Lake City, Utah), says that in Dillon, Mont., sulphur and other impurities in heavy oil cause so much difficulty that a light fuel oil had to be burned. This experience, and the added fuel cost, prevented the threatened conversion from coal to oil at a county court house and a county farm in that state.

The reasons for this widespread trouble is traced to two causes: (1) low quality residual oils contain too much sulphur and vanadium for effective combustion, and (2) the much higher heat transfer rate usually associated with packaged oil-fired units leads to deterioration of metal heating surfaces and thus to loss in heating efficiency.

NCA's Market Promotion Department makes this added comment: "When comparing the initial cost of conventional steel fire-box boilers with oil-fired packaged boilers it is important that the comparison be made on a basis of heating surface and not horsepower. Packaged boilers are frequently chosen because, on a basis of the manufacturer's rated output, their initial cost is sometimes lower than that of standard fire-box type boilers. The rated or catalogue output means nothing unless the amount of heating

surface is considered. When compared on the basis of equal heating surface, and dependable continuous steam output, the standard steel fire-box type boiler with stoker, controls, etc. has an equal or lower initial cost than the packaged boiler. In view of the trend to rate packaged boilers on the same basis as steel fire-box boilers there is no longer any advantage in the initial cost of oil-fired packaged boilers. In most cases, therefore, coal offers not only lower operating costs but also lower initial costs."

Retail

Competition Now—Tough, but easing slightly.

Competition Tomorrow—Still more easing but continuing tough for quite a while to come. Nevertheless, there is good reason to expect a rising trend in retail deliveries.

"It is our carefully studied conclusion that the domestic market has just about hit its bottom and should now have a gradual turn upward,"—David L. Francis, president, Princess Elkhorn Coal Co., stated at the meeting of the Mine Inspectors Institute of America in June (*Coal Age*, July, 1956, p 154). This conclusion—from the head of a company which last year sold a premium domestic fuel to 100,000 homes in the U. S. and Canada—seems amply borne out by the statistical record. During the first 5 mo of 1956, deliveries by retail dealers exceeded 28 million tons—a 27% jump over the corresponding 1955 period.

The 1956 boost in deliveries is most encouraging. It does not, however, mean a proportionate drop in competition from oil and gas or a proportionate increase in the number of new domestic outlets. An unusually severe winter no doubt brought greater coal use by each existing coal customer. Also, an undefinable percentage of the 1956 boost is due to increased deliveries to "off-track" and commercial installations which show up to some extent in USBM's retail classification.

The safest bet for coal is to figure that competition with both oil and natural gas remains tough in the home heating market. And there is no indication yet that this competition will not continue severe, particularly in the case of natural gas. If there is any tendency to think otherwise about gas, consider these reports from the Gas Appliance Manufacturers Association:

1. Sales by the gas equipment industry edged up in May, posting a 6.9% gain over the corresponding 1955 month.

2. For the first 5 mo of 1956, shipments of forced-warm-air and gravity-type gas furnaces totaled 286,000, or 5.8% more than in the corresponding 1955 period.

At the very least, however, realists would have to agree on this: the rising trend in gas and oil prices plus the advent of improved, automatic coal-burning equipment has set the stage for an upward movement in the retail coal market, both in total sales and in number of customers. The industry must capitalize on this opportunity by:

1. Taking the story of modern coal-heating equipment to old customers and prospects. Increased awareness of this need has already upped bituminous use in large office buildings, apartment houses, schools and hotels. Also worth noting: during the first 4 mo of 1956, sales of complete, automatic anthracite furnaces were 43% ahead of the same 1955 period.

2. Offering complete merchandising and engineering service to customers and prospects such as that extended by NCA's Market Promotion Dept. Anthracite, too, is making similar efforts through the Operation Home Improvement Program.

3. Expediting research on automatic equipment which will give customers the same cleanliness and convenience as other fuels. Paving the way are several improved residential stokers—the Campbell Stoker, the Combustioneer, the Stokermatic and the Coal-O-Matic.

4. Documenting the market. This means preparing detailed lists of existing customers and prospects for use in mail promotion and contact sales campaigns.

5. Developing indirect and alternative ways of getting coal into residential and commercial buildings as through electric space heating.

Both electric utilities and electric equipment manufacturers are stepping up their programs to promote electric space heating. Utilities' interest stems first from the availability of power in a number of areas where it has been short in recent postwar years; second, from their desire to balance their summer air-conditioning peak load with a similar winter peak load. *Electrical Merchandising*, a McGraw-Hill publication, reported as follows in January, 1956:

"A steady growing market is anticipated for electric space heaters. The same is true of built-ins (bathroom types, in-wall installations, mounted-panel types and radiant glass units) as new models are introduced, lines shortened, and electric heating of all types becomes more and more popular."

The use of the heat pump, still relatively small on the space heating scene, has a big, long-range potential. The market now has its main stronghold in Florida, California, Texas, Alabama, Louisiana, and other states where warm air is readily available for most of the year as a heat source. The heat pump has a high efficiency rating and has the additional advantage of being a year-round installation. In winter, it can be used for heating and in summer for air conditioning.

The same advantages could be more widely exploited in "cold" states if heat sources, other than warm air, can be developed more satisfactorily. At the present time, heat pump installations are usually made in "cold" states with auxiliary radiant or resistance heating elements. However, this system is not generally considered cheap enough for penetrating the mass market.

Research is active and promising on the development of lower-cost systems. In June, 1956, *Electrical Construction and Maintenance*, a McGraw-Hill publication, reported the installation of two multistage compression heat pumps which can operate economically with air-source temperature at freezing or below. As such heat pump systems become more available, electric space heating might possibly bring a major recovery of the space heating market for coal.

Still another trump reserved for play in the retail market: gasify coal at the mines and transmit it through existing pipeline systems. This may not come for two or three decades. But it bears close watching. The possibility of at least a partial "marriage" of the petroleum and natural gas industries with coal increases as the discovery of new reserves of petroleum and natural gas fails to keep ahead of their growing consumption.

Export

Competition Now—Minor in coal's principal foreign markets—Canada, Europe and South America.

Competition Tomorrow—Little if any greater in the next decade or so.

In an action unique in coal's history, exporting and producing companies, the UMWA and two major export-coal carrying railroads joined forces in June to form American Coal Shipping, Inc. This action—aimed initially at controlling ocean freight costs—provided the industry with the means of protecting a thriving overseas business moving toward 42 million tons in 1956. Total export, including possibly 18 million tons to Canada, should hit 60 million

tons for the year. (The Organization for European Economic Cooperation sees Europe's demand for U. S. coal reaching 55 million tons by 1975. The total export market could ultimately soar to 100 million tons, Walter J. Tuohy, president, Chesapeake & Ohio Ry., stated at the June meeting of the Coal Exporters Association of the United States, *Coal Age*, July, 1956, p 146.)

Some observers claim that ACS was formed to whip private shipping companies into lowering their ocean freight rates. This may be an apparent effect (the basic rate from Norfolk to Rotterdam fell \$1.50 per ton from May to early July). And the extent to which shipping companies lower their rates should certainly be a factor in determining how far ACS takes to the ocean in direct operation or leasing of ships. But the immediate cause for the formation of ACS was the constant upward trend in ocean freight rates (the basic rate jumped from \$7.25 per ton in May, 1955, to \$11 per ton in May, 1956). As a result, customer resistance to the high delivered price of U. S. coal showed some signs of stiffening which, if allowed to snowball, could possibly bring these results (*Coal Age*, June, 1956, p 55):

1. Southern producers, who now export about 90% of American coal, would be left without a market for up to possibly one-third of their tonnage.

2. Distress coal, possibly as much as 35 to 40 million tons, would hit the domestic market with an inevitable depression of domestic prices and profits.

The decision to set up ACS marked the formal acceptance of the export market as permanent by a large segment of the coal industry. But the infant corporation's biggest job—getting objectives underway—is still ahead. Fulfillment of objectives will depend in no small degree on more industry-wide acceptance of the export market as the new, major permanent outlet for bituminous. "Doubting Thomases" might recall from "U. S. Coal Props World Prosperity" (*Coal Age*, March, 1956, p 55) that:

The permanency of the export market is not seriously challenged by any upsurge in the consumption of oil, gas and hydro-power. Competitive power sources will contribute considerably to rising energy demands. But they will not generally affect coal's solid future overseas which is based primarily on the huge demand for coking coals to feed the rapid expansion in world iron and steel production.

The March feature also suggested competition from Polish coal could be weakening. This weakness, now confirmed, is epitomized by Poland's failure to meet deficit needs of major European importers. Western Europe took 8.6 million tons of U. S. coal in the first quarter of 1956—more than double the tonnage of the corresponding 1955 period. Great Britain continues to make heavy purchases from the U. S. (1,071,686 tons during the first quarter of 1956—17% ahead of last year). West Germany plans to buy 10 to 12 million tons from the U. S. during the year ending March 31, 1957. (Calendar year 1955 imports were 6.7 million tons.)

Also worth noting: Poland has lost the Argentine market. In 1955, Argentina imported 81% of her total coal needs from Poland and none from the U. S.; now she has shifted virtually all purchases to the U. S. (468,266 tons during the first quarter of 1956).

With competition and demand so favorable, the entire industry should get behind the ACS effort to solidify the overseas business. Its first task is to provide more shipping space for U. S. overseas coal and, thereby, to reduce and control ocean freight rates. Initial plans call for chartering 25 to 50 Liberty ships from the U. S. Reserve Fleet (*Coal Age*, July, 1956, p 122).

As ACS expands the scope of its activities, the agenda might include action to:

1. Improve, modernize and expand loading and unloading facilities both here and abroad.

2. Guarantee the shipment of quality coal.

3. Investigate the possibilities of cutting costs of insuring coal cargoes.

4. Conduct continuing studies of overseas markets and dollar supply.

5. Organize a customer service clinic.

6. Devise simpler marketing procedures aimed at minimizing the number of middlemen that handle a shipment between producer and consumer.

Railroads

Competition Now—Tough, with the diesel still gaining and coal tonnage still dropping.

Competition Tomorrow—Excellent chance for a coal comeback through development of the coal-fired gas-turbine locomotive. However, because of the higher efficiency of the gas turbine, compared to the earlier steam locomotives, complete recapture would

mean a market of only about half the previous tonnage, or possibly 40 to 60 million tons a year—still very worthwhile.

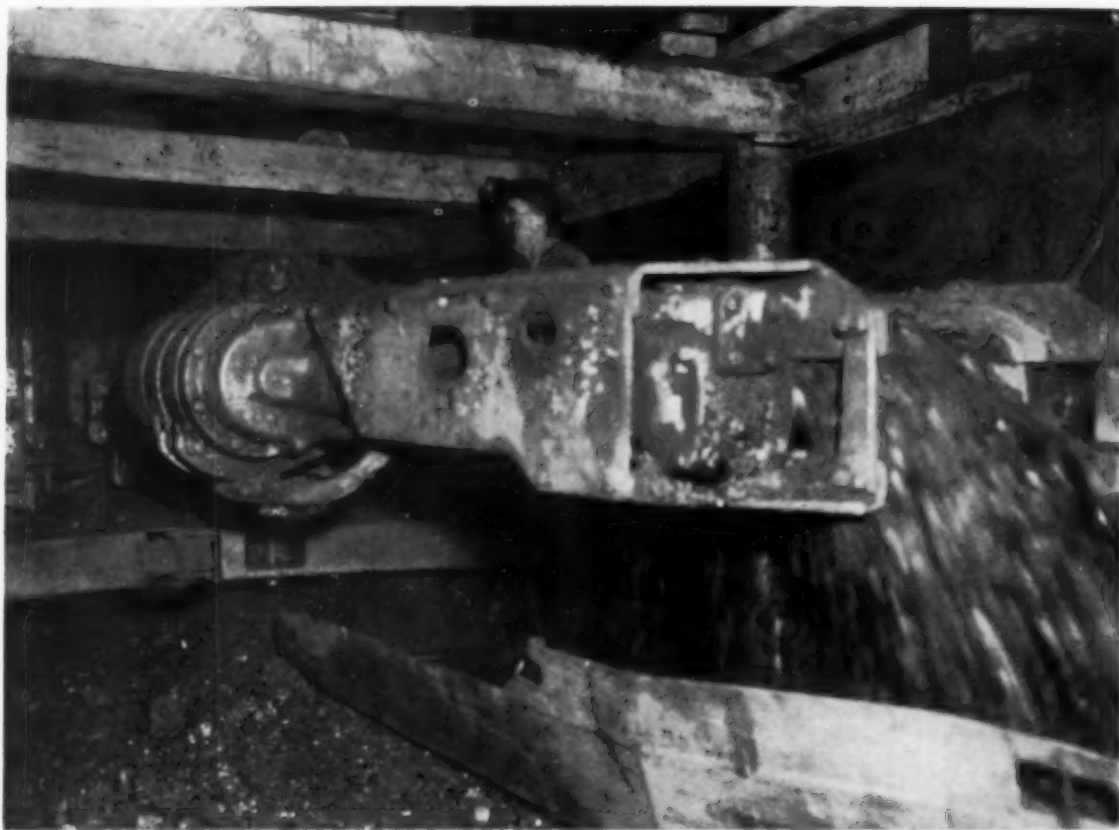
In 1954, locomotives burned 17.4 million tons; in 1955, 15.5 million tons; and in 1956, usage is headed for another drop to 14 or 14.5 million tons. The downward trend shows no signs of abating in the next 2 or 3 yr. But the industry got renewed encouragement in April that the coal-fired gas turbine locomotive may eventually put coal very much back into the picture. Speaking at BCR's annual meeting (*Coal Age*, June, 1956, p 146), Peter R. Broadley, director of research, Locomotive Development Committee, said:

"The 1955 test program subjected the LDS gas turbine to long hours of operation at load factors far in excess of normal locomotive operating practice. The general operation of the plant was much more satisfactory than in any previous test program." Putting these results into concrete terms, Mr. Broadley added that the fuel and lubricating oil cost of the coal-fired gas turbine (operating in a locomotive year of 4,000 hr) would be about \$49,000 less than for diesels.

The Locomotive Development Committee plans to start construction of a production model in 1957, which will incorporate further design improvements. And, if the promise of the stationary model bears out in the production model, coal may look forward to recovery of a major portion of the railroad market.

Thus, the industry should take a positive view toward the long-range possibility of expansion in sales to railroads. Consider this thought proposed by *Railway Age* (January, 1956, p 141): "Changes have a habit of occurring fast these days, and with today's developments in research there is no assurance that some new form of motive power may not come into the picture in the next few years that will cause the diesel to become obsolete."

Coal management might also broaden the base of its thinking toward the railroad market. Frequently overlooked are the possibilities for future growth of railway electrification, for example. More electric power on the rails, of course, means more coal use. And the industry might make a serious effort to cooperate with the railroads in extending and improving electrification systems. Where electric power is cheap, electric cars and locomotives are still much in the news and keeping pace with diesels in economy and performance.



CONTINUOUS MINER, working up pitch, discharges coal into flared pan at end of shaking-conveyor line. Room-and-pillar crews average 28 tons per man, even though extensive timbering is required in all openings.

Higher tonnage per man shift in pitching coal is achieved by using . . .

Continuous-Mining Machines with

Mining methods and supply-handling procedures at mines of Northwestern Improvement Co. in the State of Washington contribute to average productivity of 28 tons per man shift and record productivity of 63.4 tons per man shift.

AVERAGE OUTPUT of 28 tons per manshift, with 5-man crews using continuous-mining machines loading into shaking conveyors, is the operating norm in room-and-pillar recovery at mines of Northwestern Improvement Co., Roslyn, Wash. This output is achieved in spite of the fact that the seam pitches from 12 to 15 deg in most areas. Furthermore, 11 bd ft of timber must be installed for every

ton of coal removed from the seam.

The present average productivity has been progressively built up from a level of from 12 to 15 tons per manshift which prevailed in early 1952 when the first continuous miner was purchased for use in development work. NWI now has four Joy 3-JCM's in operation, each capable of producing about 5,000 tons per month in normal double-shift operation. The

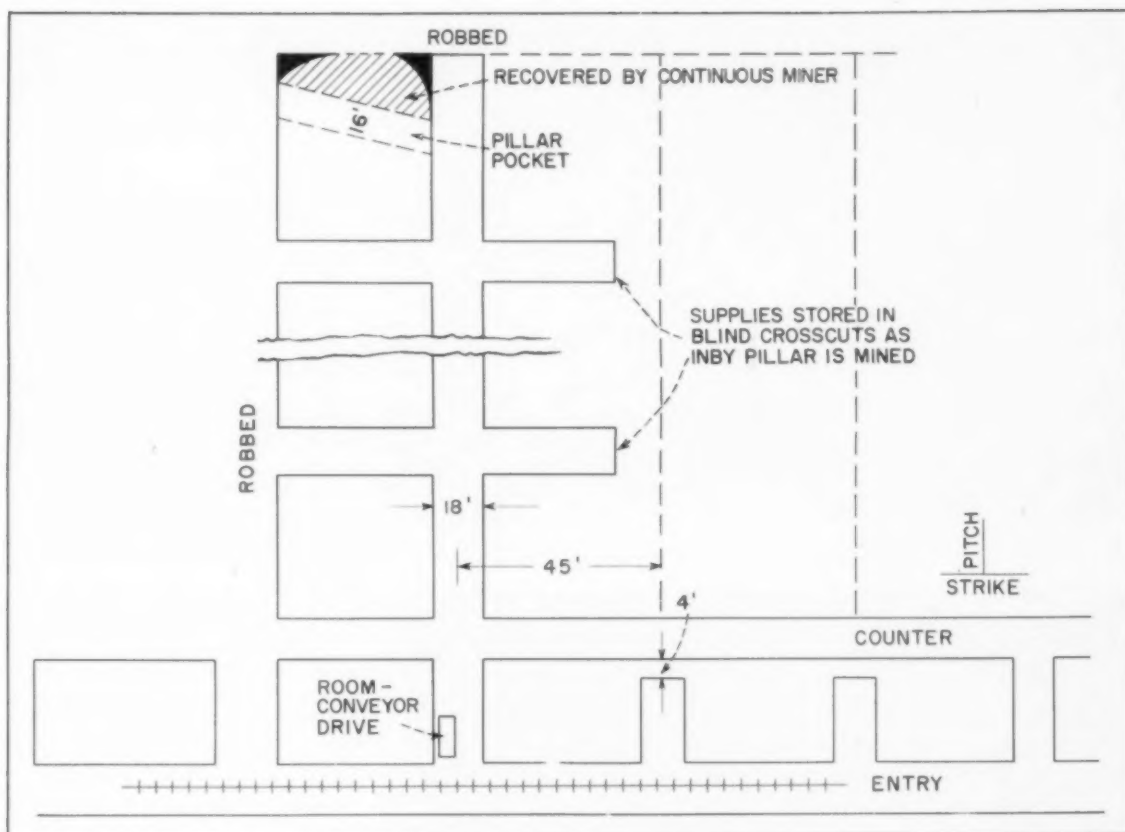
latest machine, purchased in January, 1956, is equipped with a chain-type ripping head. The other three have rotary-type heads.

MINING LAYOUT

Standard recovery methods consist of driving entries and parallel counter-entries along the strike of the seam and working rooms up the pitch a distance of 300 ft.

Main openings are a 6,000-ft slope on a maximum dip of 17 deg at No. 3 mine and a 3,000-ft slope on 37 deg at Roslyn No. 9, both penetrating the 54-60-in No. 1 (Big) seam which now provides virtually all of NWI's production. Entries are turned off these slopes along the strike on 300-ft centers to open the room panels.

Rooms are driven 18 ft wide on 45-ft centers up the full pitch from the counter. As each room is advanced,



MINING PLANS include blind room crosscuts for supply storage and room necks driven up from entry and tapped from counter by continuous miners. Latter idea eliminates any need for tramming miners in haulage entry.

Shaking Conveyors

blind crosscuts are driven into the outby solid coal to be intersected by the next room to be driven. The blind crosscuts serve as handy cubicles for the storage of shaker-conveyor pans and parts which are removed from the conveyor line as the inby pillar is retreated. Then as each crosscut is tapped in driving the next outby room, supplies for lengthening the room conveyor are close at hand.

DEVELOPING ENTRIES

The shaking conveyors discharge into mine cars. The track is laid in the entry, leaving the counter unobstructed for tramming the continuous miner outby to where the next room will be driven after the inby pillar has been recovered.

Room necks are turned off the main entry on 45-ft centers and driven almost through the chain pillar toward

the counter. Every third such opening is driven completely through to provide an entry breakthrough. About 4 ft of coal is left at the counter ends of the "blind" room necks to be broken through from the counter as each new room is opened.

Intermediate transportation from the entry and counter faces is provided by shaking conveyors. In both instances the conveyor is installed in the low side of these side-pitching openings, leaving room for the empty-car storage tracks in the entry and for a row of center posts in the counter.

Advance in the entry is one breakthrough center-distance ahead of the counter. The breakthrough is turned from the entry and intersected by the counter. Drive units of the two development conveyors are moved forward at 300-ft intervals. A cross conveyor in a breakthrough transports

coal from the counter conveyor to the entry conveyor and this unit also is moved up at 300-ft intervals.

Certain modifications have been introduced on the continuous miner to improve performance in pitching places. Conical caulks inserted into the crawler pads provide better traction to keep the machines tight against the uphill faces while sumping. Hydraulically-driven scrolls on the first three machines have been removed and replaced by simple angle blades which direct the coal on the bottom inward toward the pickup conveyor. However, the newest machine is equipped with mechanically-driven scrolls, operated through a chain from the intermediate-conveyor drive.

SUPPORTING ROOF

As previously mentioned, average timber consumption is 11 bd ft per ton of coal produced, most of the timber coming from lands of the Northern Pacific Railway Co., the parent company of NWI. Minimum standards require a timber set every



HYDRAULIC WINCH on continuous-miner chassis hauls heavy timbers up to timber jacks, forward of machine operator, for setting against roof.



FRANK BADDA, general superintendent, demonstrates air-powered chain saw which helps reduce timbering delays at the face.



SHAKING CONVEYORS discharge into 1 1/4-ton mine cars in entry. Boom man is included in 5-man crew which is provided with timber-handling aids.

5 ft. In some instances, however, it is necessary to set the timbers skin-to-skin, especially where gravel-filled "wants" have been created by stream action in the past, or where heavy pressure along synclinal axes has broken the roof.

An indication of the timbering required is contained in the record of the most productive unit shift, which occurred on May 26, 1955. The 5-man crew, using a continuous miner and conveyors in room-and-pillar work, produced 317 tons, or 63.4 tons per man. The 18-ft-wide room was advanced 47 ft in an area where the seam was 6 ft thick. Nine sets of timbers were placed, adding up to nine 8x10-in by 14-ft collars, 27 posts (all room and counter timbers are center-posted) and 54 3x8-in by 7-ft lagging planks. A few days later, May 31, the two shifts on the same unit produced 570 tons, or 57 tons per man shift.

Under conditions like these, specialized timber-handling methods had to be developed to promote maximum operating time for the miner. Here are some of the NWI techniques:

Timber is hauled into the loading head in mine cars where it is unloaded into the room neck. Each unit is provided with an air-powered Sullivan double-drum hoist which serves as a car-spotting hoist and a timber hoist. A clutch in the hoist permits either application, as necessary. One of the hoist ropes is passed through a snatch block near the face to be used in hauling the heavy timbers up the pitch to a storage point back out of the way of face operations.

The continuous miners working on the steeper pitches are equipped with small hydraulic hoists at the rear of the main chassis to speed up the job of hauling the timbers from the storage area to the immediate face area. By manipulating the rope on this hoist the timber can be brought up over the machine and set into the timber jacks, which have been fitted with semi-circular heads to receive the large timbers.

Furthermore, each unit is provided with an air-powered chain saw for faster and easier cutting of the 12-14-in posts. The saws are driven by Ingersoll-Rand Multivane hand drills which had been used at the mine before the continuous miners were purchased. The connection between drill chuck and chain-saw shaft is made through a simple universal joint to eliminate any need for close alignment.

Finally, in room-and-pillar work alternate timbers are recovered as the pillar is brought back. The recovered timbers are stored in the blind cross-



HEAVY ROOF requires strong timber sets in rooms (left) and entry (right). Room timbers are center-posted along conveyor line, and skin-to-skin timbers in entry are sealing out gravel-filled "want" created by past stream action.

cuts leading to the next room, as described earlier. Then as the new room is driven these supplies become available as the crosscuts are tapped.

RECOVERING PILLARS

One unit at No. 9 mine is recovering pillars along an inside slope, where speedy and complete extraction is essential, if trouble from excessive roof pressure is to be avoided. The main roof is a massive sandstone which must be broken clean to prevent squeezes and overriding pressure. With continuous mining, it is possible to drive a room and pull the pillar in from 12 to 14 working days.

As shown in an accompanying illustration, pillar recovery begins by driving a 16-ft-wide slant chute through the pillar, beginning at a point about 20 ft back from the face. Two timbers are set in the chute to protect the operator of the miner while the machine reaches through to complete the chute. The inby fender then is cut out by maneuvering the cutting head, leaving only small corner stumps. At No. 9 mine, these stumps must be shot out if complete extraction with the miner is not possible to achieve the required break in the sandstone roof. The procedure is repeated as the pillar is brought back.

Two types of conveyors are used at the NWI operations. A lightweight, company-made unit is employed on lower pitches and for cross-conveyor applications. However, on the steeper pitches Goodman G-20 conveyors with wide pans are used to get the proper

stroke at full room length and to eliminate buckling in the pan line. With continuous mining the load in the pan line is not so evenly distributed as with hand loading. Such uneven loading, especially in pitching work, could lead to buckling if lighter pans were used.

ADJUSTING LUMP-COAL OUTPUT

NWI officials report that size-consist analyses show less minus ¼-in coal with continuous mining than with conventional mining. Right now, production of lump coal is not a problem since most orders are for stoker and steam sizes. Over-production of lump coal at the face now would merely result in higher power consumption for crushing in the plant.

But when lump coal is in demand, it is produced at the face by sumping in the machine several times across the face, leaving blocks of coal between these cuts to be ripped out on the second pass. Productivity is somewhat reduced, but higher realization for lump sizes balances this.

When mining with favorable cleavage in the Roslyn No. 5 seam, it has been found that the amount of lump can be controlled by varying the height of the initial sump into the face. If lump sizes are desired, the sump is made into the bottom; if lump coal is not in demand, the sump is made near the center of the face and the bottom coal is mined out with a second cut.

Bit wear has been equalized to some extent by adopting the practice of

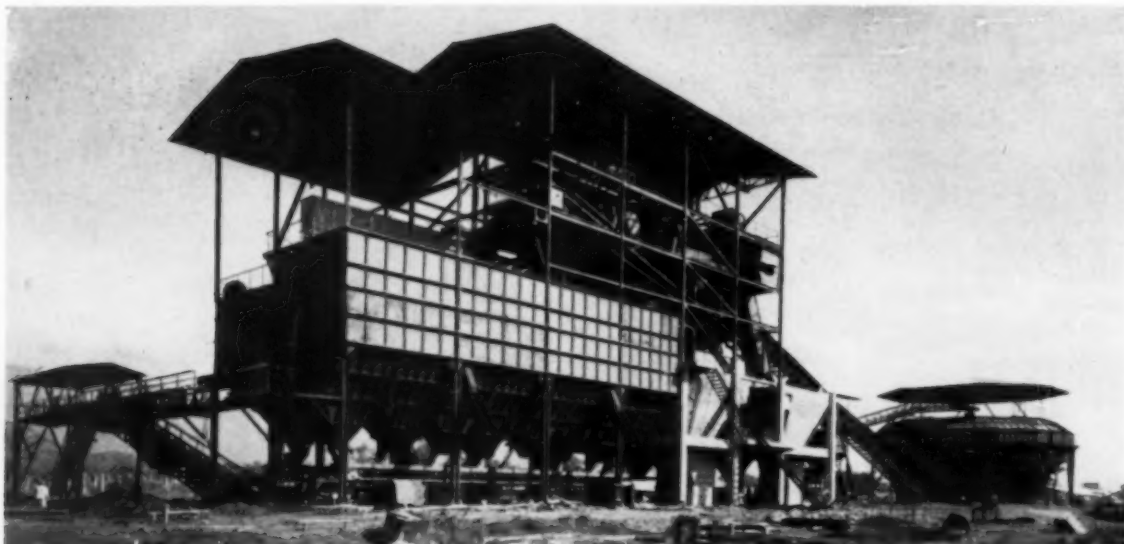
making the initial cut in the center of the face, then working successive cuts both ways from this opening cut. Thus, hardest duty is shared by bits on both sides of the cutting head.

NWI MANAGEMENT

Top management includes Robert S. Macfarlane, president, and E. B. Stanton, vice president, St. Paul, Minn., and Earl R. McMillan, manager-coal operations, Seattle, Wash. Frank Badda, general superintendent, Roslyn, Wash., is assisted by a staff including Charles Rushton, resident engineer; Arthur Walgren, safety engineer; James McKean, chief electrician; Harry Hill, preparation engineer; Arthur Pasa, mine foreman at No. 3, and Al Kosmatin, mine foreman at No. 9.

Operations began in 1886, and since that time approximately 65 million tons have been produced. It is estimated that 70 million tons of reserves remain in the 54-in Roslyn No. 5 seam and in the 18-ft-thick No. 1 seam. Only the bottom 6 ft of the No. 1 seam is mined at present because the top coal is higher in ash content. However, the fusion temperature of the ash in the Big seam is as high as 2,900 F.

Latest addition to cleaning facilities at the company's central plant at Roslyn is a McNally-Vissac feldspar jig for washing ¼-in x 1-mm fines. The unit was scheduled to begin operations following the miners' holiday. A description of the plant appears in *Coal Age*, March, 1951, beginning on p 90.



OPEN-AIR PLANT, employing conventional and feldspar jig for coal washing, is designed to clean three types of coal at 1.60 sp gr. Storage and conveying equipment are arranged to permit separate handling or blending of different coals.

Washing Cali's Coking Coal

New cleaning plant at Cali, Colombia, is designed to handle several raw coals of varying characteristics. Among outstanding features are radial bin and settling tank which serves as plant foundation.

By THOMAS FRASER, Coal Consultant, Washington, D. C.



THE CALI PLANT, and the coal-consuming centers of South America.

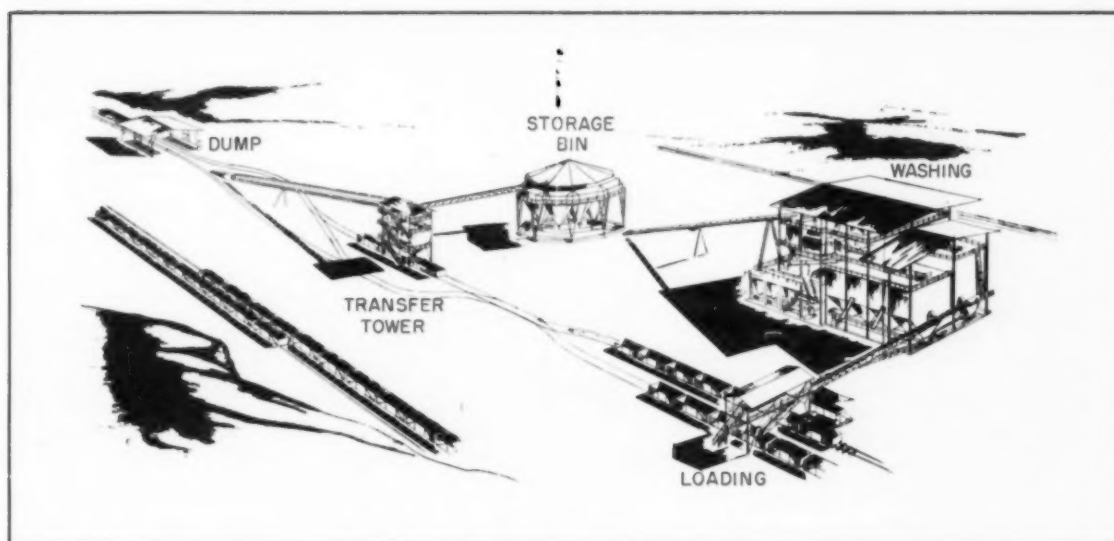
THE INSTITUTO DE FOMENTO INDUSTRIAL, an agency of the Colombian government, has erected a new modern coal-preparation plant at Cali, Colombia, to serve the Cauca Valley coal industry and to make Colombian coal available for export. The accompanying map, shows the geographical location of this plant in relation to the coal consuming centers of South America. The plant is served by the Ferrocarril del Pacifico, a division of the national railways system, which traverses the length of the valley coal field and terminates at the Pacific-coast port of Buenaventura. Modern facilities are being installed at this port for loading coal into ships.

The combined project of preparation plant construction, mine mechanization, railway improvement and port additions, followed several years of technical study by the Instituto de

Fomento, and the National Railways Administration. In this preparatory study, technical assistance was supplied by the U. S. Bureau of Mines (through sponsorship of the Department of State, International Cooperation Administration and its predecessor agencies) under a technical cooperation agreement between the governments of Colombia and the United States.

The Cauca Valley field is one of the three major coal-producing areas in Colombia. Many small mines located in the mountain range along the west side of the valley have been producing coal for local use since the last part of the 19th Century. Rapid expansion of the varied industrial activities in the valley, during and since the war, which is continuing at an accelerated rate, has doubled the local demand for coal about every nine years. Also, a need has developed, on the part of the railroad and some other consumers, for a more uniform and dependable fuel than that obtainable from the many small producers of unwashed r-o-m coal.

The new plant is designed to serve the entire industry. The plant is located strategically in the industrial area between Cali and its principal outlying industrial suburb, Yumbo, to the north. This is approximately at the northern extremity of the coal producing area; between the coal field to the



GENERAL LAYOUT of the installation at Cali, Colombia, is shown in this perspective. Coal reserves are estimated to be 20 billion tons. Coal demand in the area has doubled in the past 9 yr and will continue to grow.

south and the consuming industries and seaport to the north. Thus, virtually all the production may be processed in transit without any backhaul of the prepared coal.

Since the plant will take raw-coal deliveries from several independent producers, it was necessary to provide for separate weighing, sampling, and record keeping on separate lots of r-o-m coal. Coal deliveries will be received both by rail and by truck facilities and the need for flexibility of operation is still further increased by wide variations in types of coal to be handled and classes of prepared coal to be made. These factors have made it necessary to build extra capacity into the raw-coal handling equipment and cleaners.

CHARACTERISTICS OF THE COAL

The coal measures of this region are of early Tertiary age. The coal varies in rank from anthracitic, with 8 to 15% of volatile matter, to high-volatile bituminous with 45% volatile matter. Correspondingly, it ranges in texture from very friable to moderately firm. The accompanying tabulation gives analytical data of several typical samples, collected during the design study period. These data will illustrate this wide variation in coal characteristics. These are all r-o-m raw coal samples reported on the as-received basis.

The available raw coals range from easy to moderately difficult in washing characteristics; varying from about

5% to about 15% in near-gravity material between 0.10 units above and 0.10 units below the indicated washing gravity of 1.60. All the coals will yield a good washed product upon separation at this washing gravity of 1.60; a condition which is favorable for effective operation with the jig-type washing plant that has been provided.

It is anticipated that three general classes of washed coal will be produced. These several quality grades can be sized to suit the market. In the high-volatile group, some of the coals are strongly coking and some are non-coking. In the low-volatile and medium volatile range, those of 18% and lower are generally non-coking while those of higher than 18% volatile matter give coke. There are also some high sulfur coals that will be used only for local industrial fuel.

Typical Samples of Cauca Valley Coals¹

Sample Number	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Free-swell- ing Index
1.....	2.3	43.1	41.7	15.2	1.2	4½
2.....	1.5	45.8	46.1	8.1	0.7	5
3.....	2.4	43.8	40.0	16.2	1.7	1½
5.....	1.5	42.6	41.4	16.0	0.7	4½
6.....	2.8	37.8	34.8	27.4	0.9	3¼
8.....	0.4	30.0	62.3	7.3	2.6	9
9.....	0.7	19.2	66.7	13.4	2.9	1
16.....	0.9	37.4	39.3	23.3	1.0	5
21.....	5.1	26.6	66.1	7.3	1.8	4½
22.....	1.6	17.7	42.6	39.7	1.6	1
30.....	4.9	23.1	70.9	6.0	0.8	6½
31.....	0.4	18.2	73.4	8.4	1.2	7½
36.....	0.5	14.3	71.2	14.5	0.9	1

¹Volatile matter, fixed carbon, ash and sulfur computed to dry basis.

GENERAL PLANT DESIGN

The plant has a nominal rated capacity of 138 tph; but, because of the necessity of over-designing the equipment to cope with the wide range of conditions, especially with respect to size-consist of raw feed material, the main process units are all capable of handling a much larger thru-put than this under normally favorable conditions.

The washery is a conventional Baum-jig plant with two wash-boxes, one for coarse coal; the other, with a feldspar bed, for fine coal. The operation is tentatively set up for pre-screening at approximately ¾ in. A

supply of raw coal ahead of the washery and to classify this stored raw coal according to washing characteristics, it is expected that the washery can be operated for an entire shift, at least, on one class of coal; either the firm high-volatile coal of the Golondrinas or one of the lower volatile types from the southern field.

Operation of the washing plant may be controlled entirely independent of the raw-coal dumping and storing operations described above. The washing plant may draw its feed from any of the eight compartments of the storage plant, or from any group of compartments with the mixture under control. Under the design conditions, the raw coal handling system is rated to handle coal at the rate of 180 tph. The washery circuit, beginning with the main feed conveyor is rated to handle raw coal at the rate of 138 tph.

THE WASHING PLANT

In the cleaning sequence, the raw 4x0 coal delivered to the top of the washery building will be screened, with spray water, at $\frac{3}{8}$ in; the oversize, 4x $\frac{3}{8}$, will go directly to the primary wash-box and the undersize, $\frac{3}{8}$ x0, will go with the spray water to the boot of a draining elevator that feeds the fine-coal wash-box. Also, the fine washed coal from the primary jig, after passing thru the dewatering deck

of its draining screen, goes with the wash-water to this same draining elevator and is re-washed with the fine raw coal in the feldspar jig.

Alternatively, the plant may be operated by the Baum system of integral washing. The pre-sizing screen would be veiled so that the 4x0 un-sized raw feed would pass over it into the primary wash-box. The $\frac{3}{8}$ x0 primary washed coal would then go to the draining elevator and to the feldspar jig for re-washing.

As still another alternative method for handling the fine coal, conveying facilities are provided by which it may be delivered from the pre-sizing screen, Item 111, directly to the washed-coal storage and out-loading plant without washing. In this case, the pre-sizing screen would be operated without spray water. It is anticipated that this latter procedure may be feasible for treating some of the very friable low-volatile coals in which the finer sizes are relatively clean in the raw state. The coarse washed coal will be screened to suit market requirements and sent to storage and loading-out facilities.

The washed fine coal and water delivered by the feldspar jig will go to the de-sliming boot of a second draining elevator, an exact duplicate of the raw coal draining elevator. The washed fine coal, after this draining,

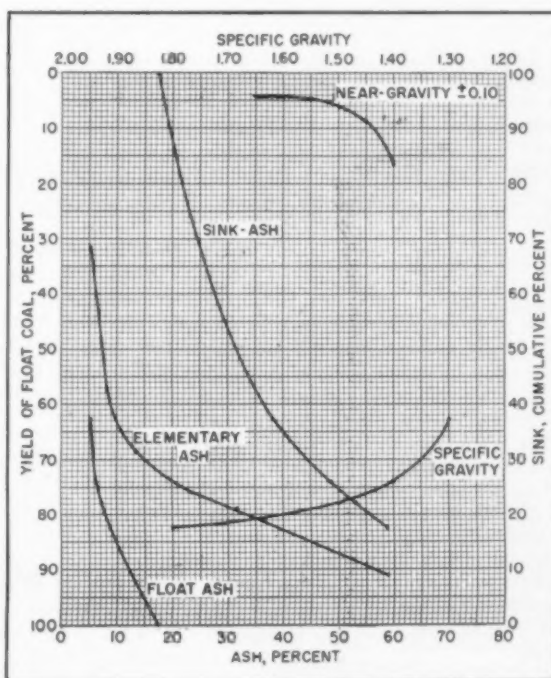
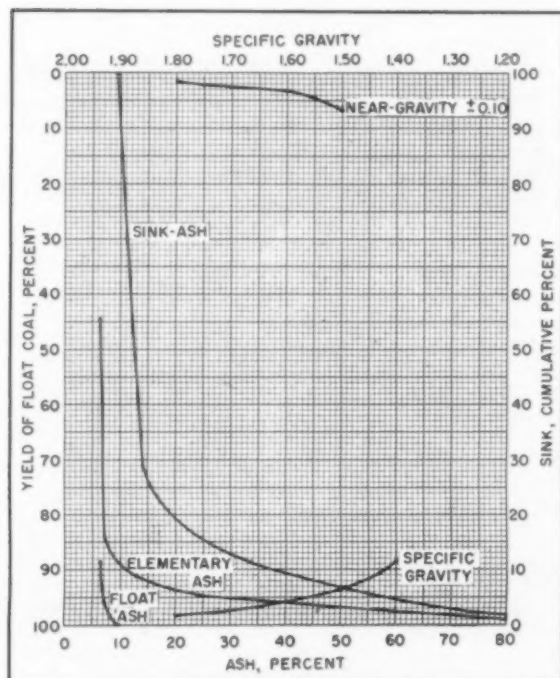
will be delivered to the draining and loading bins by a belt conveyor system which includes a movable stocking belt by which the operator can distribute the product to the various compartments of the washed-coal storage plant.

By using an alternate system, the washed fine coal may be delivered from the draining elevator to the vibrating slurry screen to serve as a draining bed for the thickened slurry when that method of slurry recovery is used.

WASHED COAL STORAGE AND LOADING

The washed coal storage plant consisting of four coarse-coal bins and eight fine-coal bins has a total capacity of approximately 880 tons; one shift's production. This gives a draining time of about 18 hr with one-shift operation. The bin discharge gates are equipped with individually-adjustable feeders that deliver to collecting and mixing conveyors below. This system of collecting conveyors, with the loading conveyors, is arranged so that any desired mixture of washed coals available in the bins may be loaded into railway cars at the loading station. Drainage rings at the storage-bin gates collect the drip water and deliver to the drainage system.

The washed coal storage plant is necessitated not only by the need for



WASHABILITY CHARACTERISTICS of low-volatile (left) and high-volatile (right) Cauca Valley coal.

draining and blending operations, but also to accommodate the plant to a possibly intermittent supply of transportation facilities.

The feeders and loading conveyors are rated at 275 tph. To complete the flexibility of the plant, a direct-loading conveyor system is provided by which the washed coal can be loaded from the dewatering screens to railroad cars, without storage.

SLURRY HANDLING AND WATER CLARIFICATION

Because of the extreme friability of some of the coals to be handled, it is anticipated that recovery of the fine coal and the clarification of washery water will be the most difficult operating problem. Adequate fresh water supply, decantation tanks, cyclone-type thickeners, a slurry screen and a combination flocculating thickener and vacuum filter plant, all of over-capacity, are provided for that department and equipped with facilities for widest flexibility of operation.

The central circulating water decantation unit is a multiple-compartment settling tank of the traditional European spitzkasten design. This is a rectangular concrete tank with 720 sq ft of superficial area (19½ ft wide by 34 ft long). This tank is equipped with a peripheral effluent collecting launder, an intermediate take-off connection and sump for the main recirculating pump, and a series of manually-controlled slurry valves at the spitzkasten outlets.

The main circulating water load to this tank is made up of the spray-water from the screens and the wash-water returning from the wash-boxes, which goes first to the two draining-elevator boots from where it overflows into the decantation tank. Each of these boots has an inside settling area of approximately 333 sq ft. There are several other small sources of dirty water such as the slurry screen, the cyclone thickeners, head-tank return and so on. The total volume of water to be handled through this decantation tank is indicated only approximately by the rated capacity of the main circulating pump, 5600 gpm. This pump takes the circulating water from the partially clarified upper level of the decantation tank and delivers it to the constant level over-flow tank (Item 226) that insures a constant uniform supply of water to the jigs. Two circuits are provided for further dewatering of the settled slurry drawn off from the bottom of the decantation tank:

1. The slurry screen circuit in which the slurry is pumped to the multi-

tubular thickener (Item 232), from which the effluent water returns to the tank and the spigot product is poured on top of the fine washed coal bed on the slurry screen (Item 129). The mixture of fine coal and drained slurry goes to the draining and storage bins while the drip water from the screen returns to the decantation tank.

2. The filter plant circuit in which the slurry pump delivers to a second multitubular thickener (gang-cyclone unit) from which the effluent returns to the tank and the spigot product goes to the vacuum filter. From the filter, the effluent water returns to the fresh water supply line of the plant. The filter cake is stored in a cylindrical storage silo of the centrifugal discharge type from which it may be loaded out on the central loading conveyor, blending with the washed coal or disposed of separately.

With the two slurry pumps available, these two slurry circuits may be operated alternatively or the load might be divided between them. The water clarification system also has a 30-ft mechanical thickener in which it is proposed to treat continuously an increment of the returned circulating water that will be delivered to it from the washery head tank. This may be operated with the addition of a flocculating agent to produce a well-clarified effluent water and the thickened slimes will go to the vacuum filter with the slurry.

It is planned to bring the water circuit into balance, with respect to ultra-fine solids content, by experimental adjustment of these circuits. Any dirty water to be purged from the system will be taken from the peripheral over-flow launder of the decantation tank and sent to the river.

WATER SUPPLY

The fresh water supply for the washing plant will be taken from the Cauca River. A pumping station at the river with a 6-in horizontal pump (with complete stand-by unit) will deliver water at the rate of 660 gpm through a 6-in Eternit pipe line, 6,840 ft long, to the primary storage tank. From this supply tank, a secondary pumping station also of 660 gpm capacity delivers the make-up water to the plant.

EQUIPMENT SPECIFICATIONS

The purchase of equipment abroad for the entire coal project was financed by the Bank of Paris and the Low Countries, and the coal preparation plant was supplied by Preparations Industrielles des Combustibles (PIC),

Fontainebleau. It is being erected by ACIG, Colombian affiliate of PIC, in collaboration with Dr. Roberto Londono G., contracting officer for the Instituto de Fomento Industrial.

For those who might be interested in the individual equipment items as compared to similar American practice, some of the principal mechanical units are described in more detail.

WASH-BOXES

Item 112—Primary wash-box, 2-compartment; 1st compartment 10x6 ft; 2nd compartment 10x7ft 4 in; screen perforations ¼-in square by ½-in spacing.

Item 124—Fine-coal wash-box, 4-compartment; each compartment 6 ft 8 in wide by 5 ft long; screen perforations ¾-in square by ¼-in spacing.

The two jigs are supplied with air by one 4-stage centrifugal blower connected to the two jigs in parallel. A complete stand-by blower with 95-hp motor is direct-connected.

FILTER PLANT

Item 403—Disc-type vacuum filter, 6 discs, 10 ft diameter, with 12 filter-bag sections. Total filter cloth area, 660 sq ft; rated capacity 15 tph, dry solids.

Item 407—Rotary vacuum pump, 220 rpm; capacity 2,400 cfm at 4.4 in of mercury.

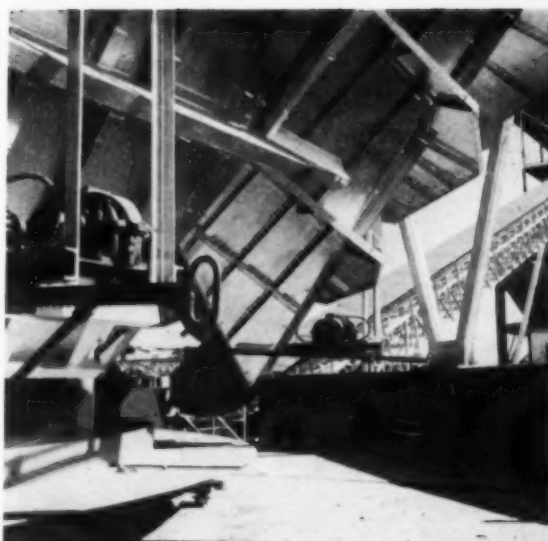
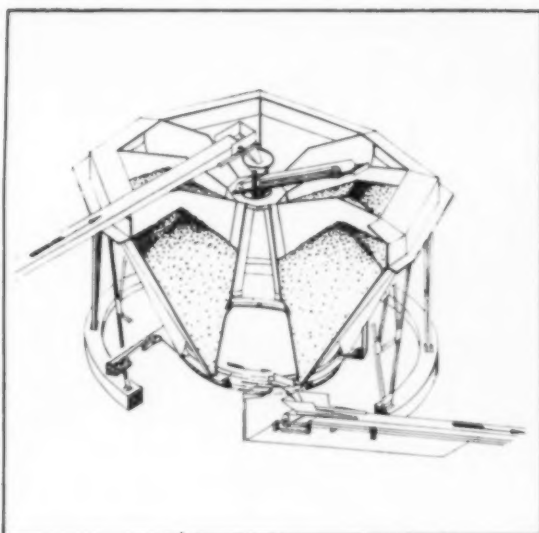
Item 409—Cycloidal blower direct-connected to 60-hp, 1,800 rpm motor.

CIRCULAR STORAGE PLANT

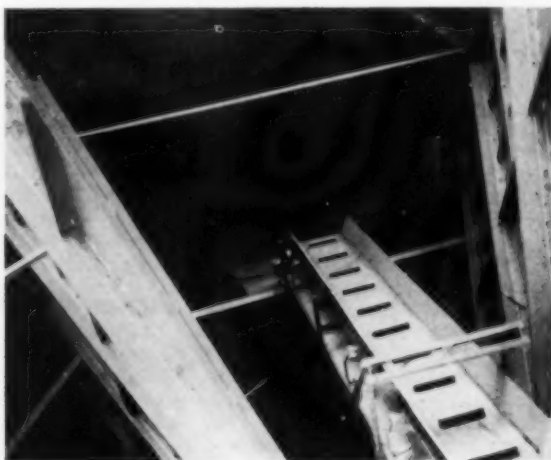
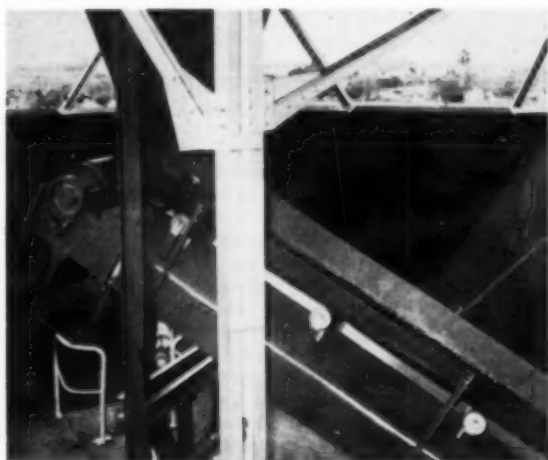
The circular storage plant for raw coal is a special design of PIC to minimize the mechanical equipment needed to distribute the coal to the various bins and to withdraw it from storage. The basis of this simplification is the disposition of the bins radially around a central service stocking unit in a circular bin-structure. The central tower carries a turntable with a 30-ft adjustable boom that may be positioned over any compartment of the bin. A cleated belt conveyor mounted on this boom delivers the coal into the bin. The boom may be lowered into a starting position from which the coal is delivered with little drop and the boom is raised as the level of coal in the bin rises so as to avoid breakage during the stocking operation.

Raw 4x0 coal is delivered to the stocking boom by conveyor through a small conical transfer hopper with spiral lowering vanes. The stocking operation is controlled from an operating platform above the boom turntable and around the transfer chute.

Withdrawal of coal from the storage bin is effected by individually adjust-



COMPARTMENTS in radial bin are loaded from swinging boom. Coal is discharged from bottom of any compartment onto rotating table, shown at right, to be plowed off into plant-feed hopper by a steel scraper fixed above the table.



STORAGE-BIN LOADING BOOM, equipped with cleated belt conveyor, may be raised with level of coal in bin to limit degradation. This type bin requires minimum space and eliminates a need for extensive conveyor capacity.

able feeders on the bin gates that spill the coal out onto a ringshaped revolving steel table which travels around under the circle of gates. This table collects the coal and delivers it to the washery feed conveyor. Discharge from the ring-table is effected by an obliquely placed steel scraper that plows the coal off over the edge of the table into the transfer chute. By adjustment of the feeders, the operator can deliver any desired mixture of the available raw coals to the washery.

SWINGING FEEDERS

For delivery of coal from the storage

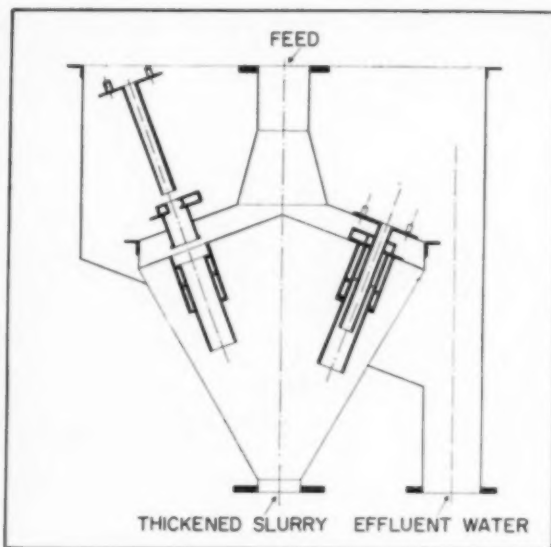
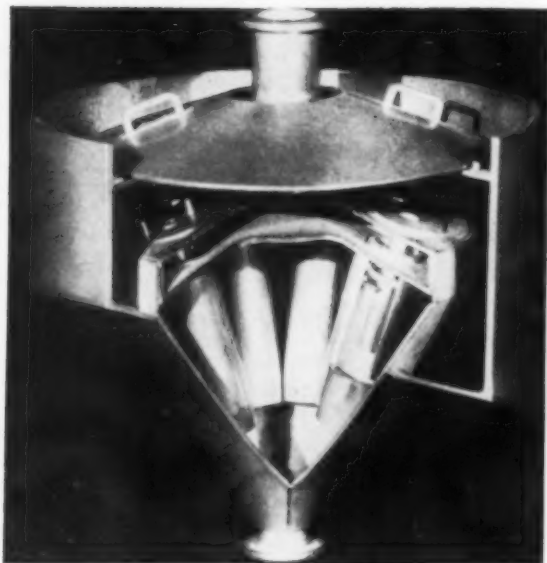
bins to the collecting ring-table, a very simple suspended feeder design is used. It is virtually the same as the common swinging under-cut gate converted into a reciprocating feeder by connecting it to a pair of driving arms and a crank-shaft.

WASH-BOXES

The unique feature of the PIC wash-box is the Wolf automatic refuse gate control. This is a float control device in which the float tube is sealed directly to the jig screen so that no slate or coal particles can enter the float compartment. The float rises and falls with the level of the water column in the tube which responds

directly to changes in water pressure in the main jig body under the screen, which in turn varies with the thickness and resistance of the shale bed accumulated on the screen.

The feldspar jig for small coal is a device that was introduced into the United States with the Luhrig system of coal washing in the 1890's, but has not been used here in modern times. In Europe it is the most widely used method of treating the fine sizes and it has been greatly improved. The adaptation of the permanent feldspar bed to large pneumatically-driven (Baum type) jigs has been developed since the war by PIC and its British affiliate company, ACCO, Automatic



TWO MULTITUBULAR THICKENERS remove water from decantation-tank underflow and deliver thickened slurry to dewatering screen or filter. Each unit handles 550 gpm. The unit is an adaptation of the gang-cyclone idea.

Coal Cleaning Co., Carlisle, England.

In this method of washing, a bed of coarse broken feldspar or equivalent ceramic material, that is intermediate in specific gravity between coal and refuse, is placed on the jigging screen. This artificial bed remains permanently on the screens and functions like the coarse refuse retained on the screens of primary jigs used to handle unsized feed. All the refuse is drawn through the bed into the hutch under the jigging screen and is evacuated from there with some of the water. There is no refuse discharge draw above the screen level. The screen openings must be substantially larger than the largest particles in the feed. This method of washing is also called "jigging thru the screen."

In the PIC feldspar wash-box used in the Cali plant, the float control mechanism is articulated with the compressed air valves to vary the pulsion as the bed resistance changes.

MULTITUBULAR THICKENER

The Turpinson Multitubular thickener is the PIC adaptation of the gang-cyclone idea. This design consists of a closed cylindrical casing which houses four tubular cyclones each 6 in in inside diameter. The feed is delivered under pressure directly from the slurry pump to a central inlet opening of the casing and enters tangentially into the feed spirals of the individual cyclone tubes. The clarified effluent water and the thickened spigot product of the cyclones are collected

to common discharge outlets of the casing.

There are two of these units in the plant, both to be used for rethickening the decantation tank underflow product before it is delivered to slurry screen or filter for final dewatering. Each unit is rated to handle 550 gpm of this partially thickened slurry water.

DECANTATION TANK

The decantation tank in the Cali washery, like the feldspar jig, is a modernized design of an old European device that was introduced into the United States with the Luhrig-system washeries in the 1890's. The unique feature of this tank is its termination at the bottom in a series of inverted pyramidal boxes (Spitzkasten) fitted with manually operated slurry-discharge valves. Thus the tank might be called a multiple settling-cone unit. There are no moving parts inside the tank. Settlement and discharge of solids is effected entirely by gravity. The slurry and water discharged from the spitzkasten collect in a launder that leads to the feed well of the slurry pumps that deliver to the cyclone units.

With this type of decantation tank it is not to be expected that the consistency of the slurry can be controlled as effectively as with a mechanical thickener; but the freedom from agitation in the settling zone will furnish the most favorable condition for settlement of the ultra-fine solids, which is the controlling factor in closing the

water circuit in the cleaning plant.

Purging of a substantial volume of water with its entrained near-colloidal fines is usually necessary to establish a balance between incoming and outgoing fines, over the entire size range. The gravity-discharge decantation tank, delivering a dilute slurry to the filter plant, combined with the auxiliary flocculating thickener processing dirty water bled out of the return circuit at the rate of 440 gpm is expected to remove enough ultra-fines from the circuit to make possible the operation of the washery with an almost closed water circuit.

The entire settling tank structure is built above ground of re-inforced concrete and it serves as part of the foundation and lower structure of the washing plant building.

BUILDINGS

All the main buildings of the plant are of re-inforced concrete and steel construction, with corrugated steel roof extended 6½ ft. All buildings are without siding except in certain small areas that require protection from rain; such as the superintendent's office and the electrical control station.

POWER

The plant will use public utility power supplied by the hydroelectric generating station at Anchicaya and delivered at a voltage of 13,200. The sub-station has two groups of mono-phase 200-kva transformers in parallel to deliver energy to the plant at 440 v.

The Coal Commentator

The Electric Way

Presumably the most vulnerable to competition, yet at the moment exhibiting a tendency to recover some of its lost ground, the home-heating market for coal might at first glance be tabbed as one of substantial paradox. When only new homes are considered, however, the paradox largely disappears, since coal's record is anything but good in this category. If it were good, the industry would be enjoying sales triple or more the present level.

Not all has been lost in these new homes, however, since the appliance load, including the heating-plant motors, is carried by electricity and most of the electric power comes from coal. All of which leads to repetition of a thought that has been voiced occasionally in the past, to wit: If you can't get in directly with better heating equipment and service (and all the possibilities have not been exhausted in these directions), or by supplying the raw material for gas or liquid fuel, why not by means of electric heat, either directly or via the heat pump? The odds are changing and a fair electric heating load may not be too far off, especially if a little push is supplied. Coal is one of the logical sources of such push.

Management Counsel

"This service is shaped to meet one of the most pressing needs of management today—the need for competent, experienced and specialized management counsel where profits are at stake."

With the preceding quote from the preliminary announcement, your commentator is pleased to go to bat for McGraw-Hill's other purveyor of technical and business information—the McGraw-Hill Book Co. The new service now being offered by the book company, under the title of *Consultant Reports*, was inaugurated July 16. The first offering, "Make or Buy," examines a question facing many business men today—how far upstream to integrate. Others already scheduled for future release deal with new money for financing company growth, determining price policies, and contemporary techniques of business forecasting. **Timeliness is the key, with quick distribution and no reprinting at a later date.**

Source: McGraw-Hill Book Co., 327 W. 41st St., New York 36; price, \$15 per individual report or \$12.50 on a subscription plan.

Booming Water

"Agriculture, industry and commerce moved to the banks of the inland waterways at an accelerated rate during the second quarter of the current year, exceeding even the fast tempo of the first quarter."

So notes American Waterways Operators,

Inc., in reporting that 147 waterside plant sites were picked during the second quarter for new or expanded operations, compared to 138 in the first quarter and a total of 470 in 1955. The construction costs for 58 of these plants totalled \$1,267,000,000, while 48 others were reported to involve \$2 million or more each.

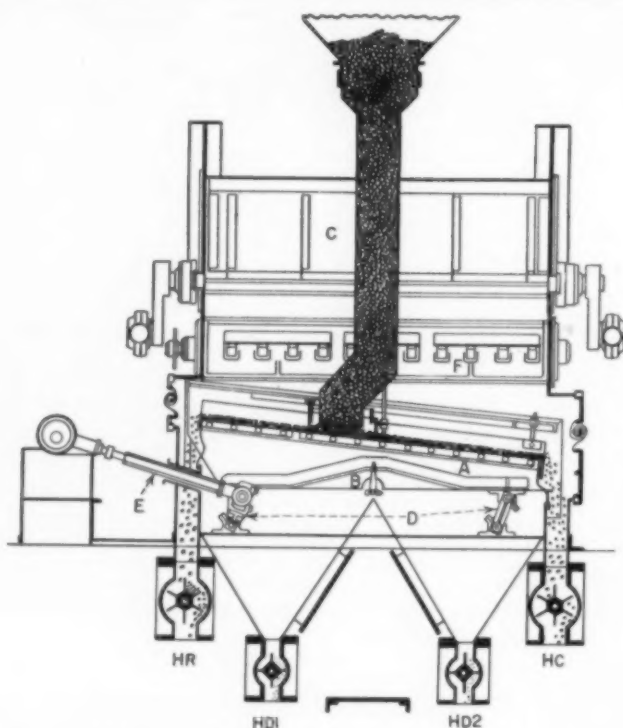
All of which means that the RAYMOND E. SALVATI, the new towboat built by Dravo for the Island Creek Fuel & Transportation Co. and christened in Pittsburgh July 25, will have a busy future, as will her contemporaries already built or to be constructed in the future. And where water is not available to carry coal, completion of the new coal pipe line by Hanna this year undoubtedly will usher in a new era of low-cost overland transportation for coal, meaning a major enhancement in coal's competitive power here as well. Both are additional good omens for the future.

Significant?

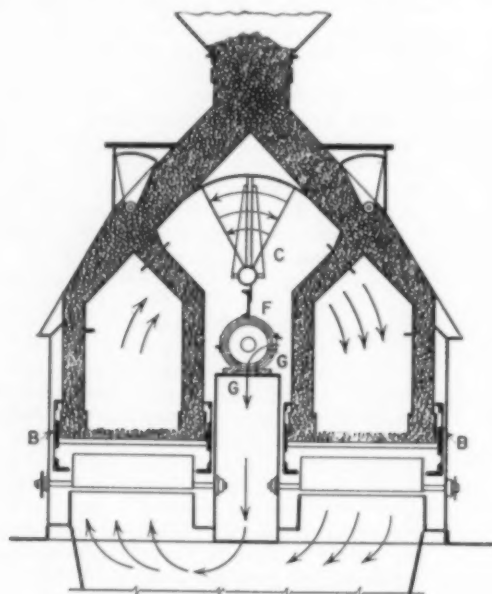
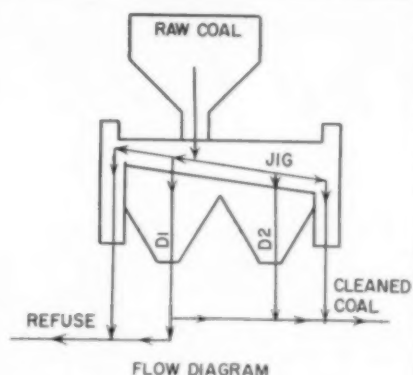
One of the things the annual vacation in the bituminous industry does is provide an indication of the extent of nonunion tonnage. The word "indication" is used advisedly, since the accuracy of the guide is not absolute. But it would seem that the union has made a considerable gain since the bituminous vacation a year ago, as gaged by the fact that the output in the week ended July 7, 1956, was only about half that in the corresponding vacation week in 1955. The tonnage in 1955 was 2,240,000, or about 25% of the average weekly rate, compared to 1,240,000, or 12%, in 1956. Time will tell whether this is a permanent change in the picture, and whether the union can make further gains. **Probably the test will be how comfortably the industry can live under the UMWA banner.**

Honor Earned

A perfect safety record for nearly two years—5,500,000 man-hours without a lost-time accident—has earned the main plant of the Mine Safety Appliances Co. an award from the National Safety Council—not the first, incidentally. In considering the significance of these awards, it needs be remembered that M-S-A was founded by mining-safety men to meet an urgent need for quality safety equipment and materials. That it certainly has—in large part because it has been forward-looking and research-minded. As a result, even though it was founded not too long ago, the scope of its products and services has long since spread far beyond the limits of the mining industry, and it serves a long and diverse list of military, governmental, industrial and civilian needs. It is logical, therefore, for M-S-A plants to be singled out for safety awards. They are honors well-earned.



CUT-AWAY VIEWS show how coal is cleaned in self-contained jigs at the Boone County Coal Corp.'s plant at Monclo, W. Va. Air circulation through the beds is shown in bottom sketch.



KEY TO CROSS SECTION VIEWS

- | | | |
|--------------------------|------------------------|---------------------------|
| A- PERVIOUS DECKING | D-SUPPORTING TOGGLES | HR-EVACUATION, REFUSE |
| B- RECIPROCATING TOGGLES | E-PITMAN ARM | HD1-EVACUATION, DUST |
| C- AIR VANE | F-ROTARY BY-PASS VALVE | HD2-EVACUATION, DUST |
| | G-BY-PASS PORTS | HC-EVACUATION, CLEAN COAL |

Dry Cleaning

Self-contained jigs in service for 5 yr in West Virginia require no external blowers, exhausters, or dust collectors. Power requirements are low for compact units. Here is the company's report on jig performance.

By R. F. WESNER
Acting General Manager
Boone County Coal Corp.
Sharples, W. Va.

THIS IS THE STORY of the performance and history of one of the dry-type, fine coal cleaners currently in use and available to the industry. The cleaner is known commercially as the McNally Brusset vacuum jig, and more commonly as the Brusset jig. Following is the experience and performance of the Brusset jig as recorded at the coal preparation plant of the Boone County Coal Corp., Sharples, W. Va. The Boone County Coal Corp. was the first coal company in the United States to install the Brusset jig, working with the manufacturer of the jig during its early field development, and at this time is one of three coal companies in the

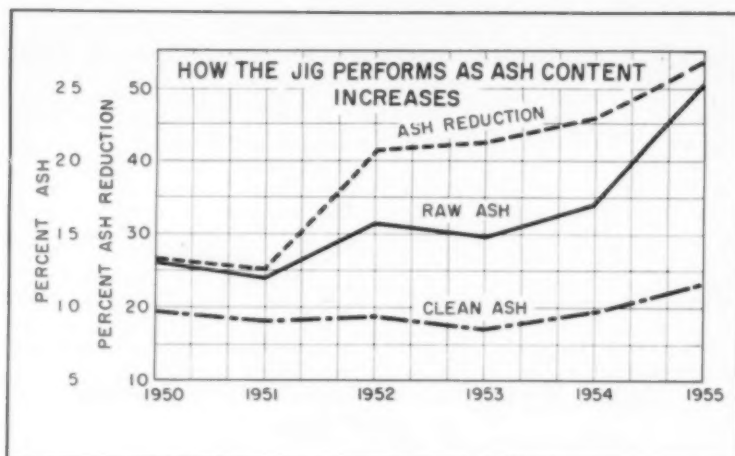


TABLE I—Cost of Operating Brusset Jig Plant, 1955

ITEM	COST (Per Ton of Clean Coal)
Operating Labor and Supplies	\$0.0325
Maintenance Labor and Supplies	0.0093
Power	0.0105
Ownership (Depreciation, Etc.)	0.0400
Total	\$0.0923

Fine Coal at Boone County

United States using the jig in normal daily duty.

PLANNING THE PLANT

In 1947, as the post-war boom in industrial and domestic use of coal began receding, Boone County Coal Corp. began plans for upgrading the quality of their slack product by considering the addition to their preparation plant of a cleaning device adequate for handling the heretofore uncleaned $\frac{3}{4}$ x 0 coal. Prime consideration was given to air cleaning this coal because of the obvious advantages gained by producing a dry coal without going to the expense of thermal drying, cleaning a coal at the lower cost usually associated with dry cleaning as compared to wet cleaning and avoiding the non-productive expense usually encountered in water clarification following a wet coal cleaning process. The production of a low-cost dry coal was particularly appealing since an appreciable quantity of the production entered the steam market and was usually sold on an "as received" basis. These advantages had to be balanced against two outstanding disadvantages of air cleaning: lower cleaning efficiency and air pollution in and about the cleaning plant. After prolonged study of the problem, which included a study of production costs as well as a study of sales realization based upon the sale of coal on the "as received" basis, it was decided to install a dry cleaning system for $\frac{3}{4}$ x 0 coal in the Boone County Coal Corp. plant at Monclo, W. Va.

It might also be pointed out that at this time, plans were also begun by

corporation officials for the ultimate replacement of the entire and nearly-obsolete preparation plant that at this time was treating all of the R-O-M coal by means of hand-picking lump coal, washing $5 \times \frac{3}{4}$ coals in Elmore jigs and loading raw $\frac{3}{4}$ x 0 coal. The air cleaning system was the first phase of the long-range plans.

Boone County engineers and officials invited proposals for the air cleaning system they desired and made a thorough study of several systems, including the Brusset jig. At that time the Brusset jig was in commercial operation only in Canada at the Western Canadian Collieries, Limited, and only in experimental operation in the United States in the laboratories of the McNally Pittsburg Mfg. Corp., Pittsburg, Kansas. The features of the Brusset jig—the jig being a self contained unit requiring no auxiliaries such as blowers, dust collectors, and having low power requirements, etc.—were quite attractive to Boone County officials and the performance of the full size laboratory jig on a carload sample of Boone County $\frac{3}{4}$ x 0 coal was convincing proof that the jig could meet the performance requirements in the corporation's plans. Therefore, a contract was made with McNally Pittsburg Mfg. Corp. for the installation of five Brusset jigs for cleaning $\frac{3}{4}$ x 0 coal at the Boone County's plant in Monclo, W. Va.

HOW THE JIG WORKS

The Brusset jig consists essentially of a parallel pair of inclined reciprocating pervious decks enclosed by

sealed hoods or compartments. The two compartments are interconnected by a duct, which is closed off by means of a swinging vane, the top of the duct being arcuate so that the vane remains in contact with it throughout its swing. The vane is approximately the same length as the decks and in height is approximately equivalent to the width of one of the decks. At the bottom it is mounted on a shaft which is externally driven in reciprocation from a crank shaft. The top of the vane swings freely through an arc determined by the eccentricity of the cranks. This arc is adjustable, but is normally operated at 60 deg, 30 deg each side of vertical. It is the movement of this vane which displaces air and produces the separating flow through the bed of material on the decks. Adjustable ports in the vane are used to further adjust the volume and pressure of the air displaced by the vane.

OPERATING CYCLE

The operating cycle is reversing. When, for example, the vane is moving clockwise about its axis, it tends to produce a vacuum in the compartment above the left hand deck. This results in upward flow of air through that deck, distending the material in the bed to produce stratification in densimetric layers. The same motion produces a positive pressure in the compartment above the right hand deck, tending to force air downward through the bed of material on the deck. The negative pressure generated above the deck under the influence of the vacuum part of the cycle is usually

regulated in the range 3 to 6 in water gauge. It has been found, however, that it is not desirable to return all the impulse air back through the deck and a relief valve is provided which, at the proper time in the cycle, opens to by-pass some of the air around the pressured deck. A by-pass compartment between the two decks opens into the space beneath the decks and thus permits all air which goes through the by-pass or passes downward through the right hand deck, to be drawn upward through the left hand deck, thus completing the cycle. At the end of the stroke, the cycle reverses and, as the vane moves in the counterclockwise direction, air is drawn up through the right hand deck. During this portion of the cycle, the by-pass ports for the right hand deck are closed but those connected with the left hand deck open at the proper point to by-pass the correct percentage of the air in motion.

CONSTRUCTION FEATURES

The decks are supported on adjustable inclined rubber-bushed toggles and are actuated in opposition through ball bearing eccentrics on a common shaft provided with a variable speed drive. Raw coal is fed at each side of each deck, close to the mid point of the length. The delivery is by means of fixed spouts, inside the airtight compartments, with adjustable gates to regulate the feeding rate. The decks of the unit, moving beneath the feed chutes, serve as reciprocating feeders.

The deck motion is such that the refuse material, settling on the deck, is conveyed up the slope, contra-gravity, to the refuse discharge end while the upper lighter strata of clean coal flow by gravity to the clean coal discharge end. Adjustable barrages at each end control the bed thickness. The inclination of the toggles and the slope of the deck are independently adjustable and a secondary adjustment provides for different inclination of a short section of each deck near the refuse discharge point.

The compartment beneath the decks is sealed from the atmosphere and from the compartments above the decks, but is open to the bottoms of both decks and to the by-pass channel between the decks. It is shaped to form two hoppers, one extending across the forward half of the two decks and the other across the rear half. These hoppers receive dust products which pass through the decks. The total enclosed volume of the jig is 314 cu ft; 183 cu ft above the decks, 131 cu ft below the decks.

Sealed rotary evacuators are provided for the clean coal and refuse discharge from each deck and for the

TABLE II—Summary of Performance, 1950 to 1955

Date	1950 Sept.	1951 March	1951 Sept.	1952 Jan.	1954 June	1955 July
Size of Feed.....	$\frac{3}{4} \times 0$	$\frac{3}{8} \times 0$	$\frac{3}{8} \times 0$	$\frac{3}{8} \times 0$	$\frac{3}{8} \times 0$	$\frac{3}{8} \times 0$
Tonnage/Hour.....	30	20	25	25	12	25
Raw Coal Ash.....	13.0	12.0	15.8	14.8	17.0	25.2
Clean Coal Ash.....	9.6	9.0	9.3	8.5	9.7	11.7
Refuse Ash.....	39.7	41.0	37.3	43.3	45.4	44.2
Theoretical Recovery.....	95.5	96.0	90.7	90.8	90.0	80.3
Actual Recovery.....	88.7	90.6	76.8	81.9	80.1	58.5
Efficiency.....	92.8	94.4	89.0	90.1	89.0	72.9
% Ash Reduction.....	26.2	25.0	41.1	42.6	45.8	53.6

TABLE III—Details of Gravimetric Quality of Raw Coal

1950 Feed Coal— $\frac{3}{4} \times 48M$				1954 Feed Coal— $\frac{3}{8} \times 48M$			
S. G.	% Wt.	% Ash	% Cum. Ash	% Wt.	% Ash	% Cum. Ash	
1.40	80.3	3.88	3.88	77.8	4.1	4.1	
1.50	6.9	15.97	4.84	5.0	18.4	4.9	
1.60	2.5	26.12	5.43	2.1	31.1	5.6	
1.70	1.3	35.00	5.85	0.8	38.8	5.9	
1.90	1.5	44.65	6.48	1.5	49.8	6.6	
Sink	7.5	83.11	12.25	12.8	85.9	16.8	
	100.0	12.25		100.0	16.8		
Ash %, 48M $\times 0$				Ash %, 48M $\times 0$			
15.82				25.0			
PERFORMANCE				PERFORMANCE*			
Recovery.....				Recovery.....			
88.7%				80.1%			
Ash %, Clean Coal.....				Ash %, Clean Coal.....			
9.6%				9.7%			
Ash %, Reject.....				Ash %, Reject.....			
39.7%				45.4%			

*48M $\times 0$ not included

two dust products. The seal confines the dust within the jig.

The six evacuators are driven from a single motor. Separator motors, with variable speed drives, are provided for the air vane, which operates in the range of 180 to 200 rpm; and for the head motion of the decks, which operate in the range 290 to 330 rpm. The by-pass valve is synchronized with the air vane. Its port openings as well as its cyclic timing are adjustable, for adaption to different types and sizes of coal being treated.

With the exception of the driving mechanisms, the entire machine is encased in a dusttight housing. Access doors, manholes and handholes are provided for maintenance and inspection. Inspection handholes are also provided and are equipped with dust-tight sleeves to permit manual investigation of the beds during operation.

JIG OPERATION

In operation, the Brusset jig differs from conventional pneumatic separators in several major aspects.

1. It is a complete processing opera-

tion within itself and requires no auxiliaries except the conveying equipment for delivering the raw feed and recovering the final products. No external blowers, exhausters, dust collectors, filters or ductwork are installed.

2. The stratification of the bed on the decks is effected by means of intermittent reversing impulses in much the same manner as a wet jig, rather than by continuous upward flow of air. The action of the vacuum jig further parallels that of the Baum-type jig in that it provides control of the "back-suction". The adjustable by-pass valve definitely controls the proportion of the impulse air which returns downward through the decks, the remainder by-passing automatically to the space beneath the decks, thereby preventing undue packing or tightening of the bed.

Thus the machine is properly classed as a jig, since it incorporates the operating characteristics of the jig, but utilizes a gaseous medium (air) instead of a liquid (water). As a matter of fact, the actuating medium is not

truly air alone, but rather a suspension of fine solids in air. The continued reuse of the original air, in a totally enclosed compartment, without any means of settling or otherwise separating the suspended dust, quickly saturates the air to its maximum carrying capacity. The result is a medium of average density appreciably above that of atmospheric air, producing in effect a gaseous "dense medium".

3. The lifting action which distends the bed of material to permit free settling of the higher gravity particles is produced by negative pressure or vacuum. This vacuum is of course maximum at the point of application, i.e., at the upper surface of the bed. Because of the resistance of the bed, the intensity of the vacuum reduces through the depth of the bed and is minimum at the deck plate. It would appear, therefore, that the greatest lifting effect is produced in the upper strata, where maximum fluidity is required to permit the cleaned product to flow by gravity, in opposition to the conveying action of the deck. Conversely, a minimum degree of agitation is produced in the lower, settled strata of heavy rejects which must remain in contact with the deck surface to be conveyed mechanically by the deck motion.

4. The dust passing through the forward or clean-coal end of the deck is kept separate from the dust through the refuse end, the two products being separately evacuated from the machine. While the separation in the -48 mesh range is not highly accurate, there is slight difference in the ash content of these two dust products and their separate discharge provides additional operating flexibility. To obtain minimum ash in the clean coal, both dust products may be diverted to the refuse. But when the requirements are not as stringent, both may be included with the clean coal. Normally, at Monclo, both dusts are added to the clean coal product. In this connection, it may be pointed out that dedusted feeds do not respond to treatment in the Brusset jig. The dust helps make the separating media, and without it the vacuum relief air currents pass through the interstitial openings in the bed too freely to provide even distention of the entire bed.

HOW COAL FLOWS

Each jig in the plant is fed by gravity from a 20-ton surge bin. This provides the means for a steady feed to each jig and also provides the air-seal required to prevent the escape of air and dust via the feed hoppers of the jigs.

The clean product is collected and

conveyed to surge bins for ultimate loading into railroad cars or blending with coarser grades for preparation of nut and slack grade coals.

The refuse product from the jigs is collected and conveyed to the Baum jig washers for salvage of any coal in the Brusset jig refuse.

The sizing of the raw coal delivered to the jigs is accomplished by screening the R-O-M coal at 1½ in with direct delivery of the plus 1½ sizes to the Baum jig. The raw 1½ x 0 is reprocessed on vibrating screens for final sizing of the air plant feed. While the Brusset jig plant addition was originally designed for treating ¾ x 0 coal, it is presently treating ¾ x 0. This change came about as a result of the overall degrading of raw coal quality by the increase of mechanical mining methods in the mines, thereby necessitating more effective and efficient cleaning of all grades of the raw coal. This change in jig feed size will be discussed in greater detail later.

The raw coal by-pass feature of the plant flowsheet is a predominant feature in the preparation of the ¾ x 0 product. The Brusset jig's performance is definitely affected by the surface moisture of the raw coal entering the jig. At surface moisture contents up to 4.0%, the jig performance is normal and satisfactory. With surface moisture contents in the range 4.0% to approximately 7.5%, the jig receives and discharges the coal with only nominal beneficiation and with some reduction in the jig capacity. At surface moisture contents above 7.5%, the jig will not pass the raw coal and it becomes necessary to shut down the jig and rake it clean to allow resumption of operation on dry coal. This clean out operation of the jig requires the time of one man for about 20 minutes. It is therefore desirable to provide a means for directing any wet or very damp raw coal away from the jig.

At one time jig-capacity tests were made under various moisture conditions. Based upon a capacity of 100% of that desired at a surface moisture content of 3.0%, which is the average of the coal feed to the jig, the following results were obtained:

Surface Moisture, %	Capacity, %
3.0	100
3.7	110
4.5	86
6.0	78
7.5	22
9.0	0

These figures were obtained under conditions during which the jig was adjusted in the direction of obtaining the maximum capacity at a reasonable

cleaning efficiency. In other words, the figures above were dependent only upon the difference in surface moisture of the feed coal.

At the Boone County plant, the mine-run dump operator controls a by-pass gate in the ¾ x 0 raw coal conveyor feeding the air plant. The gate provides means to by-pass the air plant whenever there is wet raw coal approaching the air plant. The wet coal is directed to the Baum-jig plant where it is washed, centrifugally dewatered, and combined with the clean coal from the air plant for ultimate loading into railroad cars. The dumper, based upon his experience, judges whether or not the coal being dumped is suitable for Brusset treatment.

PLANT OPERATION

The Brusset-jig section of the plant at Monclo includes the conveying systems delivering the raw coal to the jigs, and the conveying system taking the jig products away from that section of the plant. One operator is required to operate this section of the plant. This includes starting and stopping the plant, maintaining the operating adjustments of the jigs, and daily cleaning of the jig decks. With four or five jigs operating, this duty is a full-time job for one man.

Mechanical maintenance of the jigs is handled by the plant maintenance crew, working on non-productive shifts. To date the equivalent of approximately one-fifth of a man shift per day is required to maintain the Brusset-jig plant. The primary duty of the plant operator is to make frequent manual checks of each jig to determine the existing performance of each and to adjust deck toggle settings, deck speed, or any other adjustment required to allow the consistent jig performance desired. Experience has shown that extreme variations in the reject content of the jig feed or a change of 2.0% or more in surface moisture usually necessitate a change in jig adjustment. Usually a slight change in toggle setting or deck speed will correct jig performance. These adjustments can be made while the jig is operating.

In some cases where a vast change in size consists of the feed, vast and continued change in reject content of the feed, or a continued increase or decrease in feed moisture content occur, it is necessary to adjust the opening of the vent in the air vane, the height of the deck barrages, or the pitch of the decks. Any one of these adjustments can be made in a matter of 5 to 10 min, but require the interruption of jig operation. Well-trained,

experienced operators can usually determine the adjustment necessary just by "feeling" the bed of material in the deck and thereby judging jig performance. Until the operators are experienced, frequent sink-float tests of the jig products are used as a basis for jig adjustment.

MAINTENANCE

Mechanical maintenance of the jigs has been confined almost exclusively to three major items, namely: Jig deck surface material, deck mounting bushings, and deck air seals. The jig decks are surfaced with 20-gauge, bronze, perforated, crimped plates. The plates are punched with a 1/32-in hole and contain 19% open area. The plates are purchased as flat perforated sheets 9 ft long and 18 in wide. Each deck requires two plates. The plates are crimped or "stepped" by the jig plant operator in a small break made especially for the job and located in the Brusset jig plant. The operator usually has enough spare time on regular shifts to prepare an adequate supply of crimped deck plates for all of the jigs in the plant.

The deck plates normally last approximately 2,500 hr. During this period they are sometimes broken accidentally during cleaning but can readily be restored by soldering. Replacement of the deck surface on one deck requires one man-shift of labor.

The deck mounting bushings are Lord Company hard rubber bushings with 1 1/4 in I.D. and 3 in O.D. Each deck requires 8 mounting bushings and one bushing at the deck pitman rod connection pin. The pitman rod bushing and the two bushings nearest the drive end of the deck normally have a life of 3,500 hr. The remaining bushings will normally have a life of 4,000 to 8,000 hr. Each bushing replacement requires about four man-hours of labor.

The deck air seals are fiber boards mounted on the rubbing surface between the reciprocating deck and the jig housing. To date these seals have been replaced one time, at the end of three years' operation, on the Boone County jigs. The cost of the seal material is practically negligible, but about five man-shifts labor per jig is required to replace seals.

The cost of treating coal in the Brusset jig is shown in Table I. These figures include the operation and maintenance of the Brusset jigs and the conveying system delivering 3/4 x 0 raw coal to the surge bins ahead of the jigs, and receiving the 3/4 x 0 clean coal and refuse products from the jigs. The sizing of the raw coal, the loading of the clean coal, and the rewashing

of the jig refuse is not included in the cost shown on Table I.

The operation and maintenance of the Brusset jig plant is a relatively simple matter requiring strict attention only to changes in the characteristics in quality of the jig feed. Jig performance is consistent as long as there are no wide variations in feed quality. Over a five year period the Brusset jig feed at Boone County Coal Corp. has constantly shown an increase in the percentage of heavy rejects present in the raw coal. The quality of the Brusset jig clean coal during that same five year period has shown a tendency toward a higher ash product. Fortunately the increase in clean coal ash has been at a decidedly lower rate than the increase in raw coal ash over the same five year period. In that time, raw coal ash has increased from 13.0% to 25.2%, while clean coal ash has increased from 9.6% to 11.7%. At the same time the refuse quality measured in ash content has remained fairly constant, 39.7% to 44.2% ash.

TESTS AND RESEARCH

During the early stages of operation of the Brusset jig at Monclo, extensive testing and research was sponsored by the operator and manufacturer of the Brusset jig to satisfy any condition of operation that might be confronted, including size of feed, feed quality, moisture content of feed, etc.

Tests were made on 3/4 x 0, 3/8 x 0, and 1/4 x 0 feeds, on many rates of jig feed, on automatic reject control mechanisms, and on various deck surface designs, plus several other phases of jig operation.

The following conclusions were made, based upon the extensive tests recorded at the Boone County Coal Corp. plant:

1. Percentage of reject removal under given conditions ranged from 48% to 64% for 3/4 in, 3/8 in or 1/4 in top size feeds. The rate of separation of rejects from coal in the 48Mx0 size range did not vary over 20% regardless of the maximum particle size of the jig feed. In the 48Mx0 range the reject percentage was 30% to 34% for any size range of feed coal. The greatest effect of size range of feed coal on jig performance was in the capacity of the jig. For a given separating efficiency, jig capacity ranged from 30 tph for 3/4 x 0 feed, 25 tph for 3/8 x 0 feed, to 22 tph for 1/4 x 0 feed.

2. Reduction of tonnage based upon the aforementioned capacities being normal for the given size range of feed, did not provide direct relationship between capacity reduction and

separation efficiency improvement. Considering the performance noted on Table III, 1954 as normal, reduction of feed tonnage to 14 tph improved performance only to the extent of improving separating efficiency from 89.0% to 90.5%. At feed tonnage below 14 tph there was no improvement in efficiency and at tonnages below 11 tph separating efficiency declined rapidly. The reduction in efficiency at very low tonnage is due to the occurrence of blow-holes or thin spots in the bed of material on the jig deck which impairs stratification on the deck.

At feed tonnages above that noted as normal, separating efficiency drops rapidly as tonnage increases so that with approximately 30% increase in normal feed rate, separation on the jig becomes nil and only very slight beneficiation of the raw coal can be realized.

3. Various automatic reject controls were tested with only intermittent or slight success. The hindering factor in using an automatic device in the Brusset Jig is the difficulty of devising a device for feeling, weighing, or otherwise determining the quality of material at any given point on the bed.

JIG LIMITATIONS

Following nearly 6 yr of practical operating experience with the Brusset Jig, the operators at Boone County Coal Corp. feel that the jig is practical for application on fine coal with the following limitations:

1. Capacity of the jig should not be expected to exceed 30 tph on any feed up to 3/4 in top size.

2. The surface moisture of the feed coal must be limited to a maximum of 4.2% with an average surface moisture of about 3.75%.

3. The quality of the raw coal should not be widely variable in rejects, preferably with intermittent variation of reject percentage, limited to plus or minus 20% of the average reject percentage. The reason for this conclusion being the lack of instantaneous automatic controls on the jig for increasing or decreasing rejects removal during variation of feed quality.

4. The rate of reject removal of the coal cleaned in the jig should not be expected to exceed 65% and should be expected to fall in the range of 50% to 60% if coal loss in the reject is to be under 25% of the reject material. If the ash resulting from this performance meets the desired specifications the Brusset jig can satisfactorily deliver a clean coal product.



FIG. 1—STEEL-BAR CHAIN with bearing plates carries lightly constructed conveyor belt and also moves it along.

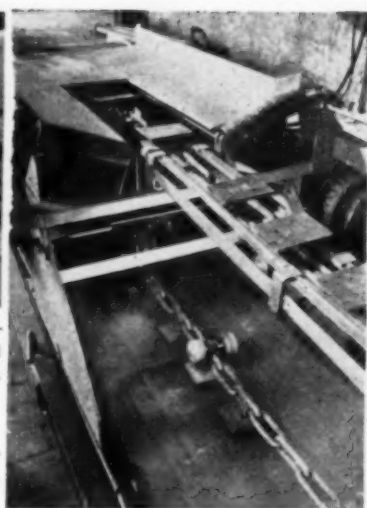


FIG. 2—BEARING PLATES of round-link chain rest on the return strand of the belt and move it along.

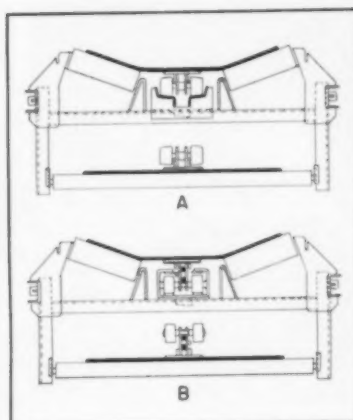


FIG. 3—CENTRAL TRACK replaces carrying idler and guides roller-equipped round chain in new design.

New Conveyor Types For Lower-Cost Coal Handling

Now being pioneered abroad, several new types of horizontal and elevating conveyors may soon find application in U. S. mines and plants. What the new units are, where they can be used and how they stack up are summarized below.

By HANS W. VON DER RECKE

Sales Engineer,
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NECESSITY BREEDS PROGRESS, and a remarkable degree of progress has been made in the mechanical handling of materials. While much is known of new materials-handling devices built in the United States, little has been published here on recent developments in Europe. Since an exchange of ideas is not only stimulating and thought-provoking, but also helps us to make progress, I shall in the following describe some European trends which have come about in the past 5 yr.

Political and economic circumstances have greatly influenced the work of European engineers. Shortage of raw materials, and the necessity to accomplish much with limited means have been, in many instances, the

Abstracted from a paper contributed to the semi-annual meeting of the American Society of Mechanical Engineers by the Materials Handling Div.

governing factors for new designs. The result has been savings in material and operating costs, as well as greater flexibility in particular equipment.

Such trends are evident in, among other things:

Belt conveyors which can be built to almost unlimited length and at the same time use light and inexpensive rubber belting.

Conveyors which can handle material on the forward as well as on the return strands across valleys or rivers.

Belt conveyors which carry material on inclines up to 65 deg.

Conveyors which can carry bulk material around vertical and horizontal curves.

BELT CONVEYORS

The rubber belt of a belt conveyor serves a dual purpose: (1) carrying the load and (2) transmitting horsepower from the driving pulley to move the load. The ability of the belt

to carry the load remains unchanged regardless of the length over which the load has to be transported or the height to which it has to be lifted. However, the horsepower for driving a conveyor increases with its length and lift. An increase in horsepower demands a proportionally stronger and, consequently, more expensive rubber belt. In many instances, the cost of the belt is as high as the cost of all the mechanical components of a belt conveyor. In addition, replacement of the belt, which is subject to much wear, is ordinarily necessary at regular intervals.

Hence, it has been attempted to reduce the initial cost of a heavy conveyor belt by replacing it by a lightly constructed one whose function is restricted to carrying the material only. Imparting forward motion and transmitting the horsepower is performed by an inexpensive chain or wire rope.

The advantages which can be expected from such a belt conveyor design are:

Relatively low purchase cost.



FIG. 4—INTERMEDIATE DRIVE STATION—has sprockets chained together to synchronize speed of sections.

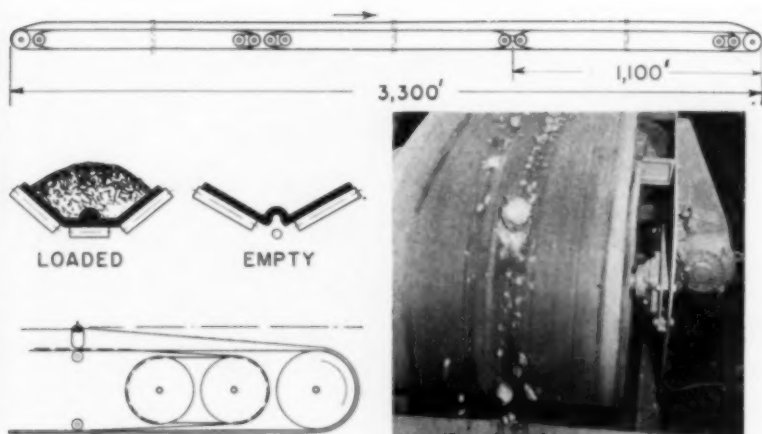


FIG. 5—WIRE ROPE inserted in recess in specially constructed belt supplies traction in this design.



FIG. 6—HOW WIRE-ROPE OPERATED conveyor belt looks when set up for service.

Less danger of a belt fire because there is no belt slip at the pulleys.

Almost unlimited conveyor length.

Power requirements estimated at up to 50% less than those of ordinary belt conveyors.

However, it should be emphasized that these conveyors are still in the experimental stage, and what appears to be promising at the moment might not turn out to be an actual improvement.

Steel-Bar-Chain Propulsion—The first conveyor to be discussed here propels the belt by means of a steel-bar chain (Fig. 1). Every second or third link of the chain is provided with a bearing plate which supports the top run and carries the belt with the material lying on it. On the lower run the bearing plates rest on the belt and move it along in the opposite direction (Fig. 2). Tensile forces in the belt are almost entirely eliminated. Belt breaks cannot occur. It is possible to use even patched rubber belts or new, lightly constructed belts of low tensile strength. Considerable cost advantages are gained.

Standard terminal pulleys and troughing and return idlers can be used except that the center roll of a troughing idler is replaced by a chain guide roll or by a track. This means that standard belt conveyors can easily be converted with retention of most of their existing machinery and structure.

Round-Link-Chain Propulsion—If a round-link instead of a steel-bar chain

is used as a means of imparting the forward motion to the conveyor, the haulage capacity can be considerably increased. The round-link chain (Fig. 2) can run at a speed of as high as 500 fpm, while the speed of a steel-bar chain is restricted to 200 fpm maximum. The chain is equipped with roller attachments and is guided on a central track (Fig. 3). Model "A" is intended for conveying either uphill, downhill or horizontally. Model "B" is used with conveyors which negotiate vertical curves. Conveyors can be made almost any length if intermediate drives are inserted. However, one separate chain must be used for each intermediate drive section (Fig. 4). If the tail sprocket of one drive section is coupled with the driving sprocket of the following section a synchronized conveyor speed is assured.

Forty-five of these conveyors with a total length of approximately 60,000 ft were in operation at the time this article was written.

Rubber-Covered Steel-Wire-Rope Conveyor—With the same goal of separating the tension-carrying from the material-carrying elements, rubber-covered wire rope of high tensile strength has been used, in another design, in place of the steel chain.

However, the conveyor belt must be of special construction for this application. This belt is made of only a few plies of cotton duck (Figs. 5 and 6). It is strengthened at the edges and in the specially designed middle section by diagonal layers of reinforcing material. The middle section includes a groove over the total length of the bottom side of the belt into which the power-transmitting wire

rope is inserted. The gripping action by the belt is strong enough to prevent slippage under any load condition. The heavier the load, the more the adherence between the rope and the belt. Special two-pulley idlers near the head end of the conveyor open the groove and separate the rope from the belt. The rope is then free to be guided over the driving sheave.

To limit the diameter of the wire rope, long-run conveyors can be subdivided into several flights, and intermediate drives can be located every 2,000 to 3,000 ft. For example, on a 1¼-mi-long conveyor, the first drive would be at the first third of the conveyor length. This drive would operate the first and the second flights. The third flight would be driven by a second drive located at the head end of the conveyor. At the transition from one flight to the other, the wire rope of one flight is separated from the belt, and the rope of the following flight is inserted in its place. The carrying belt continues uninterrupted over the entire length of the conveyor.

The material can be discharged over the conveyor head pulley or at any point along the conveyor path by raising the belt and tilting it. Owing to the special construction of the belt at its center, a flexible joint action is obtained which results in better than normal troughability. Standard conveyor idlers can be used. However, the belt is loaded with the largest cross section if the end pulleys of the idlers are inclined at 40 to 42 deg. Ridges and ruffles can be molded on the carrying side of the belt to prevent rollback of the material on slopes. Slopes up to 25 to 30 deg can then be negotiated safely.

The centrally located driving rope



FIG. 7—CONVEYING BELT suspended from rail beam and operated by ropeway.

FIG. 8—STEEL HANGER developed for use with suspended conveying belt.



FIG. 9—MATERIAL-DISCHARGE ARRANGEMENT for suspended conveying belt.

supports a large part of the weight of the conveyed material and will, therefore, result in a saving in power. Practical experience has not yet been gained with this conveyor. It was exhibited for the first time in 1954, at the Mining Fair in Essen, Germany, (Fig. 6).

Several problems still remain to be solved by the inventor. The complete lack of tension will cause belts wider than 24 in to sag between idlers. There is no doubt that the belt design will have to be improved. Ribs will have to be added while the middle of the belt and the cable will serve as backbone. Furthermore, the drives will have to be perfected because the spliced joints of the cable might damage the sheaves. An additional shortcoming is that the sheaves now used have too small a diameter to give satisfactory service.

Although some of these new types of belt conveyors have been well accepted in Europe, only time will tell whether they will open up a more practical, and more economical, way in belt-conveyor design.

A comparison with American practice shows that American engineers have most successfully solved the problem of moving heavy loads farther and higher. This has been accomplished by new conveyor belting designed for longer runs and higher lifts. In contrast to the European method, no change of the standard machinery components for belt conveyors is necessary, yet the belt is lighter in weight than duck and rubber belting of equal strength and more resilient than steel-reinforced belting.

SUSPENDED CONVEYING BELTS

The separation of the carrying from the power-transmitting elements featuring the conveyor design previously discussed also has been employed in other inventions. One result is a most interesting attempt at "crossbreeding" a belt conveyor and a ropeway (Fig. 7). The operation of this system is as follows:

An ordinary ropeway is equipped with profile steel hangers spaced on 5-ft centers (Fig. 8). The hangers are suspended from rollers running on a rail beam, and carry at the bottom a hinged tray in which the conveyor belt lies.

Material can be loaded onto the conveyor at any chosen point.

The hangers carry the belt in the same position on the forward and return runs. At the discharge point, guide sheaves attached to the hangers run over a special rail bar, Fig. 9, which tilts the tray to an angle of 90 deg. Consequently, the belt takes a vertical position, and can be led around a turn-pulley (Fig. 10). The advantages of this conveyor are:

Unusual conveying length can be achieved without transfer points.

Inexpensive rubber belts can be used even for long conveyors.

Larger tonnages than with ordinary belt conveyors can be moved because of deeper belt troughing and higher belt speeds.

Danger of fire is reduced because the belt is carried in trays and is not subject to excessive friction.

Vertical and horizontal curves can be negotiated.

Materials can be carried in either direction—on the forward as well as on the backward runs (Fig. 11).

Doubts about discharging the material from the conveyor or leading the belt around the turn pulleys have been eliminated during early test runs of a pilot model which proved essentially the following:

Conveyor speed can be as high as 800 fpm.

There is no problem in tilting the belt around a 90-deg angle within a distance of twice its width. The belt, being subject to centrifugal forces, forms a radius while it turns.

Another question was possible sagging of the belt between the trays, and also the height of the trays, which did not permit the installation of supporting idlers at the loading points. However, solutions to these problems were found. The trays were made of plate steel and, consequently, impact idlers could be installed at the loading points. Sagging of the belt was prevented when the belt and the pulling rope were taken up independently from each other.

Finally, it can be stated that the inventor has developed a materials-handling device which is functioning well. A price saving will, no doubt, occur on long conveyors with carrying capacities of between 400 and 5,000 tph.

The "Gliding Belt"—A similar conveyor type was developed by "crossbreeding" a belt conveyor with a ski-

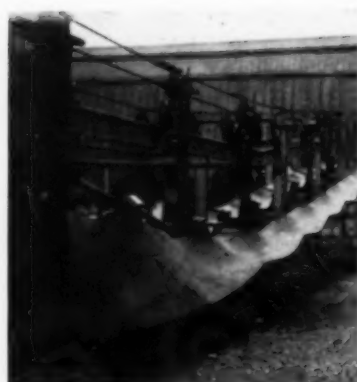


FIG. 11—SUSPENDED CONVEYING BELT can carry material on return strand as well as forward. Strands can be side by side.

FIG. 10—TURN PULLEY designed for application on suspended conveying belt.

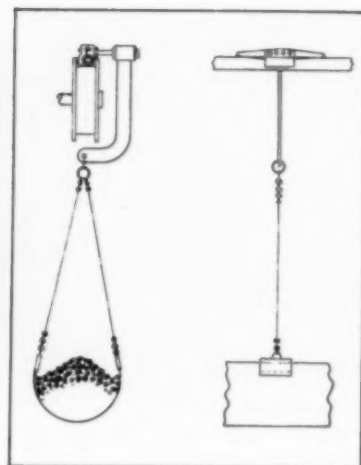


FIG. 12—GLIDING BELT is suspended from rail beam and operated by rope.



FIG. 13—CARRYING BELT of gliding conveyor is suspended on chains.



FIG. 14—DEEP POCKETS decrease rollback with gliding belt.

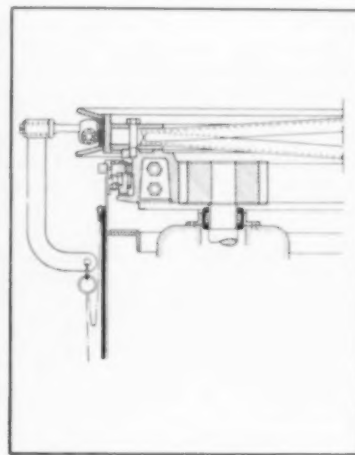


FIG. 15—ROPE WHEEL with drive and turn pulley for gliding belt.

lift, and has been named "Schwebband," which could be translated "Gliding Belt."

The device differs from the well known ski-lift in that the seats which carry the skier uphill are replaced by a troughed conveyor belt (Fig. 12). The belt is suspended from chains which are fastened at the belt edges and hang from steel buckles, which in turn are clipped to the rope. The rope way is spanned between conveyor supports (Fig. 13).

Like those previously described, this belt also does not have to transmit any driving power. The wire rope carries and moves the belt along. The only major forces to which the belt is exposed are those generated during the loading operation when the belt

has to catch the material between two buckles. The belt must be of such construction that it will stretch to a certain degree when it goes around curves to compensate for expansion and compression. A pilot installation has shown the following:

A belt consisting of only two plies, but reinforced to five plies at the edges, has proved the most successful.

The length of the chain should be equivalent to the width of the belt.

The belt should be suspended at centers 1.2 to 1.6 times belt width.

The sides of the empty run, as well as of the loaded, take on a wavy shape (Fig. 14). Deep dents are formed at those points where the chains are fastened to the belt. These dents subdivide the belt into cells into which

the material is squeezed tightly. Back sliding or rolling of the material on inclined conveyors is thus prevented. Angles up to 30 deg have offered no difficulties.

The greatest advantage for the purchaser of a gliding belt is the low price of the belting. A saving of at least 50% over a standard conveyor belt has been estimated for long installations. However, it must not be forgotten that this saving is offset—to a certain degree—by the additional requirement of a wire rope. Although a wire rope is comparatively inexpensive, it will have to be replaced several times during the life of the belt.

The wire rope of a ski-lift is constantly under tension and can, there-

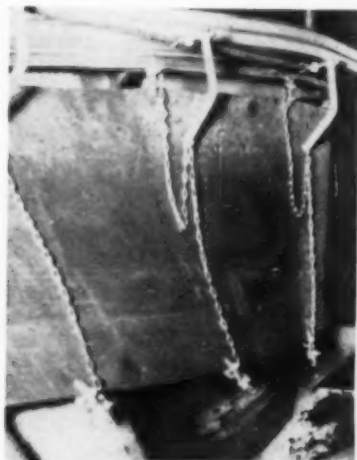


FIG. 16—HOW GLIDING BELT is led around turn pulley to reverse direction.

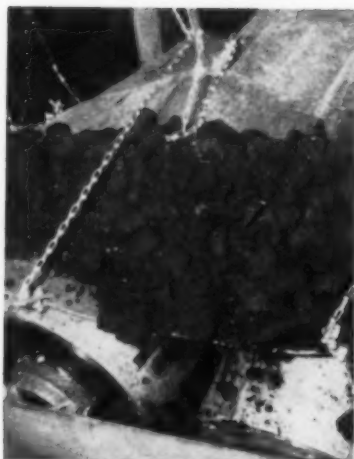


FIG. 17—TILTED IDLERS discharge material from gliding belt.

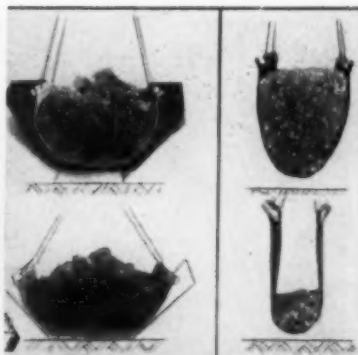


FIG. 18—GLIDING BELT during loading and transporting stages.

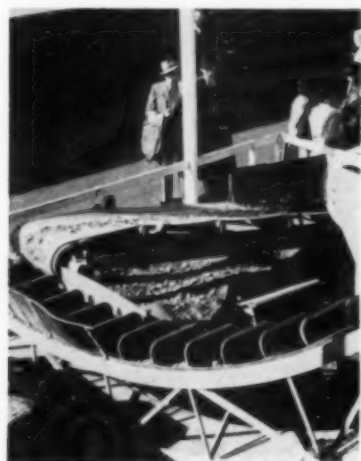


FIG. 19—ELEVATING CONVEYOR BELT with cleats in belt.



FIG. 20—TROUGHED CONVEYOR BELT can handle 6-in lumps at 65 deg.

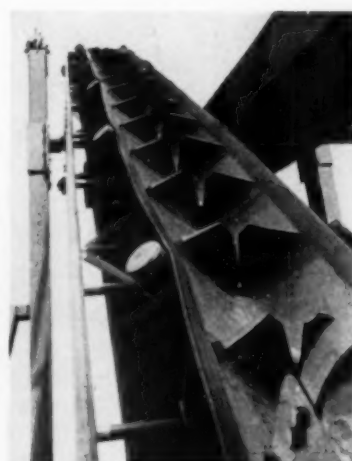


FIG. 21—CLEAT SECTION forms solid wall over idlers on carrying run.

fore, be expected to stretch. This means, in the case of the gliding belt, that any elongation of the rope has to be matched by the elongation of the belt. To achieve this synchronized stretch, the belt is led over a take-up pulley which turns loosely and independently from the rope-drive wheel (Figs. 15 and 16). There are other advantages in taking the belt up, since a tight belt will not sag easily, and also will remain in a more stable position when exposed to strong winds.

To protect the belt, it seemed desirable to unfold it before bringing it around the terminal pulley. First, the belt is guided between two side rollers, then it is carried and lifted by flat idlers which are installed in succession, in increasingly tilted positions, below the belt ahead of the terminal pulley. This arrangement provides at

the same time a simple and easy way of discharging the material from the belt (Fig. 17).

The gliding belt will have an estimated 50% higher capacity than a standard troughed belt conveyor. This higher capacity is the result of a considerably larger cross-sectional area, which is achieved by special troughing idlers under the loading point. Each of these idlers is built of three pulleys of equal length, with the side pulleys inclined $47\frac{1}{2}$ deg (Fig. 18). During loading of the conveyor the suspension chains are, of course, slack.

The load on the belt and the belt weight itself should be kept to a minimum to reduce the forces acting on the rope. It is, therefore, desirable to use narrow belts, and to increase accelerating its speed. The maximum speed with which this conveyor can

operate has, however, not yet been determined. During trial runs, the conveyor has reached a speed of approximately 1,000 fpm.

Although the cleaning of the belt is not of major importance, because the carrying side of the belt does not come in contact with any machinery parts, it is advisable to remove sticky or frozen material from the belt to prevent it from being carried back. It is satisfactory to hose the dirty carrying side of the belt while it turns, unfolded, around a terminal pulley.

To summarize:

1. The design of the gliding belt, including the method of loading and unloading, has been proved in practice.

2. The gliding belt will have about



FIG. 22—SPECIAL DISK IDLERS support return of elevating conveyor.

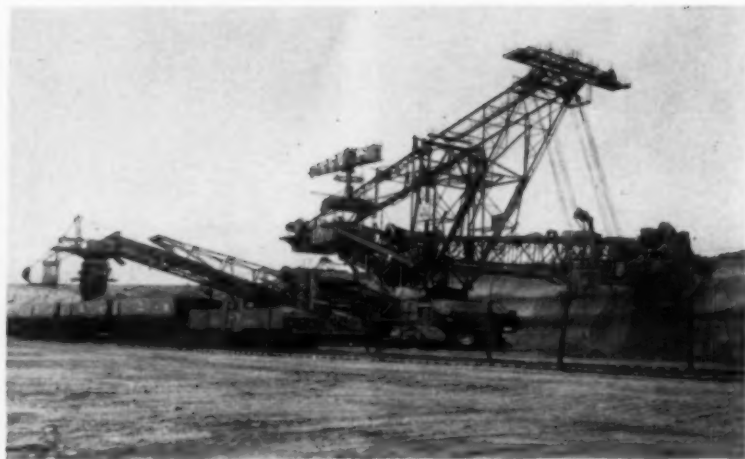


FIG. 23—BUCKET-WHEEL DREDGERS used in Germany now are equipped with special "hugger belts" to enable them to discharge material at greater depths.

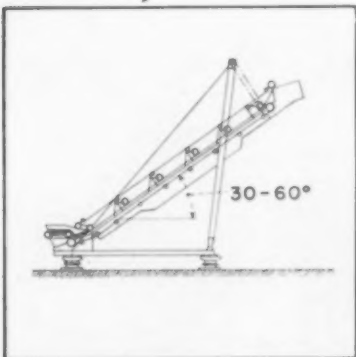


FIG. 24—HUGGER BELT over regular belt on elevating conveyor.



FIG. 25—WHERE HUGGER BELT meets regular belt on elevating unit.



FIG. 26—AUTOMOBILE TIRES press hugger belt down on regular belt.

50% higher capacity than a conventional belt conveyor of the same width operating at the same speed.

3. The gliding belt can operate safely at the same or at a slightly higher speed than a normal belt conveyor.

4. The belt can be narrower and lighter, and therefore cheaper, than the belt for a conventional belt conveyor. Savings of as high as 50% can be expected. However, these savings may often be offset by maintenance including frequent replacement of the wire rope.

5. Less power is required for the gliding belt because carrying and return idlers are eliminated.

6. The ultimate application of a gliding belt is limited by the strength of the wire rope and the length of the

span. Maximum rope diameter is 2 in. and maximum length of span is 500 ft. For long conveyors, it will be necessary to add intermediate supports.

ELEVATING CONVEYORS

The potential range of sizes, speeds, and capacities of belt conveyors is so great that these factors seldom determine whether a belt conveyor will serve the purpose. Of all the main physical characteristics of the plant requiring a belt-conveyor system, the most important is the relation between the horizontal distance the material has to be transported, and the vertical distance it has to be lifted. These two factors determine the angle of inclination of the conveyor. If this angle of inclination is so great that the material will roll back on the belt, it may be necessary to combine a conveyor with some other mechanical, and usually expensive means, for lifting the material. To avoid this additional equipment, it has often been the practice

to equip a conveyor belt with cleats which prevent the material from rolling back at steep inclines. When the material consists of large lumps these cleats can only be effective when they are of a certain height. High cleats, however, create new design problems.

Cleated Belts—Much effort has been expended in finding a successful solution to the cleat problem. An interesting type of elevating conveyor equipped with cleats was exhibited at the Mining Fair, at Essen, Germany, in 1954 (Fig. 19). The cleats are inserted into slots on the conveyor belting. They are made of pieces of used rubber belt, and can be of almost any chosen height. Side walls can also be added to prevent the material from sliding off to either side. Fixed idlers are eliminated, and are replaced by rollers attached to the belt below the cleats.

The rollers can guide the belt in channels around horizontal and verti-

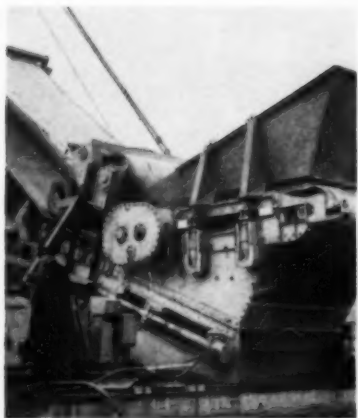


FIG. 27—LOADING HOPPER for elevating conveyor with hugger belt.



FIG. 28—CURVE-GOING CONVEYOR features linked apron sections.



FIG. 29—INTERMEDIATE DRIVING STATION for curve-going conveyor.



FIG. 30—FLEXIBILITY permits putting return strand up along rib.



FIG. 31—RETURN STRAND can carry materials into mine.

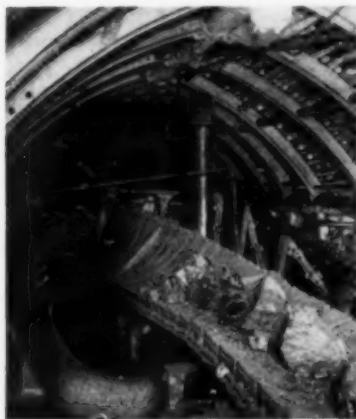


FIG. 32—CURVE-GOING CONVEYOR STRAND tilted 60 deg for discharge.

cal curves. On horizontal curves a conveyor requires, of course, additional side rollers. The minimum radius is 25 ft.

During the loading operation the belt runs in a slightly downward direction to let the material come to a state of rest before it is lifted.

The drive consists of a standard conveyor pulley. Material is usually discharged over the head end, but it is also possible to discharge it at any intermediate point by tilting the belt into a vertical position.

The conveyor also can be used in a declined position at transfer points in place of chutes, which would be too shallow to give the material the desired flow. The capacity is estimated at 150 to 200 tph with a belt width of about 18 in.

Troughed-Belt Design—While the conveyor previously described uses a flat belt, troughed designs include the

one shown in Fig. 20. This conveyor is capable of elevating material containing lumps up to 6 in at an angle as steep as 65 deg. Belt speed is 200 to 300 fpm. Here, again, cleats prevent the material from rolling back (Fig. 21). Two cleat sections are fastened to the belt parallel to but independent from each other. These sections close up to a solid wall when the belt is led over two-pulley troughing idlers supporting the carrying strand. For the return strand special return disk idlers are required (Fig. 22). The belts are manufactured in widths ranging from 16 to 36 in. Several installations are already in operation. However, the experience gathered until now is not great enough to permit passing judgment on the success of this design.

The "Hugger Belt"—The problem of carrying material on a steeply inclined belt conveyor also has been ap-

proached in other ways, as on bucket-wheel dredgers (Fig. 23). The modern bucket-wheel dredger has an extraordinarily large capacity, ranging up to over 11,000 cu yd per hr. The digging element is a wheel with buckets attached thereto. The material is discharged by gravity onto a belt conveyor. Until recently, maximum working depth was about 17 ft because ordinary conveyor belts could not transport the material at inclines steeper than 18 to 20 deg. To work to greater depths it became necessary to develop an "elevating conveyor."

It was soon recognized that belt conveyors must be retained because of their high capacity, and that to prevent the material from rolling back another belt would have to be added to hold the material tightly onto the carrying belt.

The resultant "hugger belt" (Figs. 24 and 25) lies on top of the material

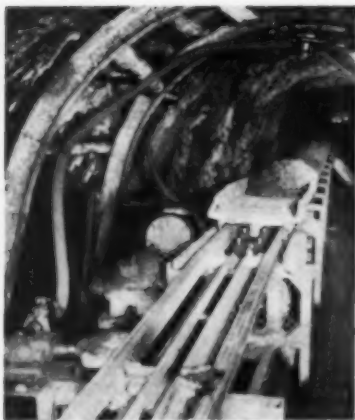


FIG. 33—APRON-CONVEYOR "TRAIN" approaching drive.



FIG. 34—APRON-CONVEYOR TRAINS can be switched like regular trains.



FIG. 35—HOPPER GATES are opened automatically by conveyor train.

on the carrying belt and prevents it from rolling back. Both belts are driven at a synchronized speed independently from each other. The hugger belt is pressed down on the carrying belt, and on the material, by spring-actuated automobile tires. Both belts are of standard design to make repairs or replacement easy.

It is possible with this arrangement to negotiate angles up to 40 deg without any difficulty. The automobile tires which press the hugger belt onto the carrying belt are shown in Fig. 26. The loading point is illustrated in Fig. 27, which also shows the top idlers above the hugger belt. These are necessary to prevent it from being raised by strong winds.

Naturally, this type of "elevating conveyor" is also used for various stationary applications.

CURVE-GOING CONVEYORS

The introduction of belt and apron conveyors to the European coal-mining industry during the first quarter of this century has brought advantages greater than any other type of mechanization. However, they could not be used in pitching seams, where more and more production was being concentrated, especially in Germany. Mining men and designers in that country therefore concentrated on developing a conveyor that would be able to follow the course of such a seam. This conveyor had to be able to go around curves and had to be of almost unlimited length to avoid transfer points. Thus the problem was clearly defined.

The resultant curve-going conveyor (Fig. 28) consists of a number of "linked" aprons which make it possible for the strand to negotiate horizontal curves. The secret is the connection

between apron sections. The minimum half radius has been determined to be 20 ft. Extraordinary conveyor lengths can be achieved if intermediate drives (Fig. 29) are installed.

The "linked" apron strand has great flexibility which permits the return to be led along the wall, as in Fig. 30. An additional twist even makes it possible to carry material on the return strand (Fig. 31).

The discharge of the material is accomplished by twisting the strand around an angle of 60 deg (Fig. 32). Any material can be carried from the mine as well as into it. Armor plating can be installed to permit cutters and other equipment to operate from the unit at the face.

Ten conveyors of this type have been installed in the German Ruhr. They are now operating with amazing precision and reliability. Some of these conveyors are as long as 8,200 ft. Power consumption is extraordinarily low. German engineers foresee a great future for this design.

Conveyors for Pitching Seams—Although characterized by great flexibility, linked-apron conveyors have been used exclusively for mining horizontal seams, since their high capacity, in relation to the low output, makes them uneconomical for pitching veins. Nevertheless, they have served as the basis for units designed to cope with pitching-seam conditions.

During installation of the usual curve-going conveyor the normally endless apron-strand is divided into several sections. These sections are then placed on the supporting truss and are driven over it for alignment. This is easily accomplished because a drive not only pushes the strand but also pulls it. Consideration of this fact

led to the conclusion that the conveyor sections need not be coupled in conventional fashion, and to the further conclusion that the sections could be operated like trains of cars riding on the carrying truss "track" (Fig. 33) as long as the length of a conveyor section was sufficient to reach from one intermediate drive to the next. Thus, one drive would pull the section up and then push it to the next, which would pick it up and move it along.

The length of strand section in practical application is determined by the distance over which the material has to be hauled and required capacity. An average length of 400 ft has been found very economical.

This apron-conveyor train can run over switches to different roads (Fig. 34). One or several trains can serve various working faces. Equipment and materials also can be carried into the mine.

The use of any number of trains 22 or 30 in wide permits tailoring the conveyor system to any required capacity. The drives are fully automatic and are turned on or off by the trains themselves. Consequently, the drives are running only as long as they have to move a train to the next drive. The hopper gates also are automatically opened or closed for loading by the conveyor train (Fig. 35). The switches are remotely controlled. The truss consists of standardized sections which are easily erected or dismantled, and can be used over again when the conveyor has to be moved to other roads.

Although 22 mi of this type of conveyor has been furnished to the mining industry, the construction should still be considered as in its infancy. It can reasonably be expected that the design will be improved.

Progress and Problems In Roof Support

Model testing and mine experimentation lay the foundations for better bolting. With better support, there should be greater concentration on the problem of keeping men out of the "danger zone" between the last permanent support and the face.

By EDWARD THOMAS

Mining Engineer (Roof Control), U. S. Bureau of Mines, Washington, D. C.

ROOF-BOLT INSTALLATION to date has been largely on the basis of methods determined by experimentation in advance of general use throughout the mine. Very little investigative work had been done to develop mathematical formulas that could be used beforehand to determine the spacing of bolts, effective angle of installation, the best anchoring device, or the best diameters of drill holes and rods.

For accurate testing of stratified mine-roof structures under laboratory conditions, an improved centrifugal-testing apparatus was designed and built in the Bureau of Mines laboratory at College Park, Md. As designed, the apparatus provides a means of simulating gravity loading in a model. By the employment of strain gages it is impossible to determine the state of strain in the model for all loads up to failure, the actual distribution of stress, and whether the loaded model behaved as a beam with rigidly fixed ends or as some other type.

As the apparatus was found suitable for testing, in that the stress distribution produced in the simple beam models agreed with theory, it was decided to test models of bolted mine roof. In effect, the research was directed toward development of a scientific method of designing safe and efficient rock-bolting systems for a mine roof based on the physical and mechanical properties and the observable structure and sequence of the mine-roof strata. As this research proceeded in the laboratory, basic research in rock-bolting in underground mines continued. Under a cooperative agreement with the Youngstown Mines Corp., the facilities of the Dehue mine

(W. Va.) were made available to the bureau for investigation relating to all phases of rock-bolting. Three reports had been published on this mine research by the end of 1955 (ED. NOTE: R. I. Nos. 5154, 5155 and 5156).

GOOD BOLTING

In bolting to insure good roof control, the rock bolts should be installed immediately after the exposure of new roof, and they should be preloaded enough to minimize sag of the roof over the opening. The problem of measuring the preloading stress on a bolt was partially solved by using a commercial-type torque wrench. Tests on slotted-type roof bolts installed in a conventional manner indicate that a torque of 260 ft-lb applied to the nut will produce a load of 10,000 plus or minus 2,700 lb on the bolt. In spite of errors introduced by frictional effects in the nut-bolt-bearing plate assembly, the torque wrench is considered to be a practical instrument for checking the tightness of slotted-type roof bolts.

Tests on the torque-load relationship for $\frac{3}{4}$ -in expansion-type roof bolts disclosed that a torque of 200-ft-lb applied to the bolt will produce a load of 7,960 plus or minus 2,880 lb 90% of the time. For most installations of this type of bolt, the torque wrench can be considered sufficiently accurate. These determinations were made with flat mild-steel bearing plates. Since release of the publications some manufacturers have marketed embossed bearing plates and hardened washers, either of which will alter the torque-tension relationship. If either or both are used this revised relationship should be determined locally.

Apparatus and procedure were developed for testing the anchorage effectiveness of slotted-type mine-roof bolts. In this it was found that if the driving distance of the bolt was more than 1.25 in, satisfactory anchorage was obtained. Thus, driving distance could be used as a criterion for satisfactory anchorage.

The results of one part of laboratory research on the theory of model testing as applied to rock bolting, and directed toward development of a scientific method of designing safe and efficient rock-bolting systems, were published in March, 1956. The research period was from 1952 through 1955.

BOLTING FORMULAS

The theory of model testing as applied to rock-bolting required the investigation of theoretical and experimental stress analysis under centrifugal testing conditions. By the use of dimensional analysis, a general expression for a rock-bolting design formula in terms of the structural variables was obtained which, in turn, was transferred into an exact equation by experimental testing of models. The exact equation can be used for the design of rock-bolting systems. Basically, complete understanding of the model-prototype similarity requirements by the use of dimensional analysis is not necessary if the final result of the experimental work is acceptable.

The basic design formulas for rock-bolting systems is presented in Report of Investigations 5155, Equations 7, 12 and 14 (ED. NOTE: See accompanying table). The formulas are derived from the experimental determination of the values of the variables found by dimensional analysis, R. I. 5154, Equation 16. These design formulas provide a means of determining how much support is furnished by various bolting plans rather than indicating how much support is needed.

Abstract of a paper presented at the 1956 annual meeting of the Rocky Mountain Coal Mining Institute.

Roof-Bolting Formulas

$$RF = \frac{SF'}{SF} \quad (\text{Eq. 7, R. I. 5155})$$

$$RF = \frac{1}{1 - D} \quad (\text{Eq. 12, R. I. 5155})$$

$$D = 0.265(bL)^{-1/2} [NP(h/t - 1)/w]^{1/2} \quad (\text{Eq. 14, R. I. 5155})$$

$$\Sigma = f_2 \left(\frac{KwL}{E}, \frac{P}{EL^2}, \frac{L}{t}, \frac{L}{h}, \frac{h}{t}, N \right) \quad (\text{Eq. 16, R. I. 5154})$$

$$\sigma_x \text{ max.} = wL^2/2t \quad (\text{Eq. 1, R. I. 5156})$$

$$\gamma_{xy} \text{ max.} = 3wL/4 \quad (\text{Eq. 2, R. I. 5156})$$

$$\delta = qL^4/384EI = wL^4/32Et^2 \quad (\text{Eq. 3, R. I. 5156})$$

Term Definitions

RF, reinforcement factor produced by bolting (equals SF'/SF).

SF, safety factor for unbolted roof.

SF', safety factor for bolted roof.

D, decrease in bending strain resulting from bolting, expressed as a fraction of the theoretical value for bolted roof.

b, spacing between bolts along opening, inches.

L, roof span, inches.

N, number of bolts per set across opening.

P, bolt tension, pounds.

h, bolt length, also equal to thickness of bolted roof, inches.

t, thickness, inches, of bolted roof beds.

w, unit weight of rock, lb per cu ft.

Z, unit strain, inches per inch, lengthwise of beams.

f₂, undetermined function.

K, centrifugal loading ratio (for prototypes, K equals 1).

E, modulus of elasticity, immediate rock rock, psi.

P, bolt tension, pounds.

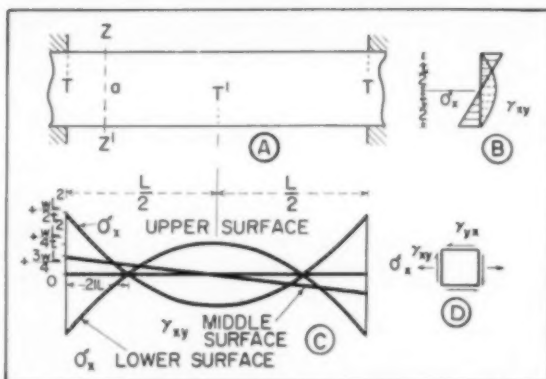
σ_x , unit stress, psi, along the beam.

γ_{xy} , unit shearing stresses in the lengthwise and vertical directions of the beam.

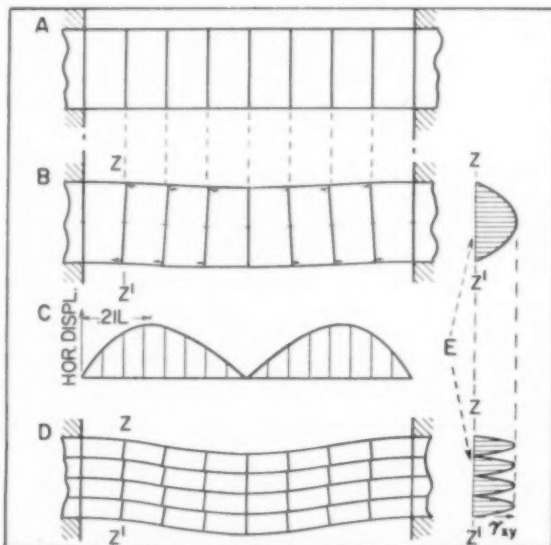
δ , deflection of the beam at midspan, inches.

q, uniformly distributed beam load, lb/in (equals wbt for a gravity-loaded beam).

Roof-Beam Action



A—Gravity-loaded beam; B—Bending and shearing stresses, Sec. Z-Z'; C—Distribution of outer-fiber bending stress and middle-surface shearing stress across span; D—Stresses acting on element at a. Failure in flexure by tension cracks, T and T'.



FLEXURE OF GRAVITY-LOADED BEAMS

A—Plane cross sections before flexure; B—After flexure, showing directions of horizontal displacement; C—Horizontal displacement of points on upper and lower surfaces; D—Flexure of a series of gravity-loaded beams showing bedding-plane slip; E—Distribution of shearing stress through Sec. Z-Z', single beam and series of beams.

However, if an existing bolting system is inadequate, the formulas can be used to determine the present reinforcement factor and the most effective way to increase it. Use of the equations and their application is simplified if the physical properties of the rock are determined beforehand.

BEAM THEORY

As in any mine-support computations the use of the formulas, together with the chart presented in R. I. 5155, requires a basic practical knowledge of mine roof control. The basic principles of reinforcing a bedded mine roof with bolts are presented in R. I. 5156. It was necessary to develop the basic principles of rock-bolting patterns through the use of elementary beam theory and through tests designed to prove or disprove certain fundamental premises. Complete understanding of the results of the testing is not necessary if the data of the experimental work are accepted. How-

ever, an understanding of elementary beam theory is required so that intelligent use can be made of the physical properties of the rock acting as the mine roof.

Formulas for computation of the bending stress, shearing stress and maximum deflection, together with detailed diagrams of flexure of gravity-loaded beams, are presented in R. I. 5156, Equations 1, 2 and 3. Determination of the physical properties of the rock will permit computation of the shearing and bending stress and deflection of the beam over a certain

span. Suitable rock-bolting patterns can then be determined by the combined use of the design formulas presented in R. I. 5155, and the employment of the essential principles involved in using vertical bolts.

Future research work in the use of rock bolts and their space patterns is expected to be continued by the bureau. The primary effort at present is being directed toward the testing of bedded roofs with unequal thickness of strata. Our underground testing is being shifted to mine areas where trouble has developed in anchoring

bolts. Newer types of bolts which provide greater applicable beaming surface are being tested and attempt is being made to develop and standardize failure warning devices.

WARNING DEVICES

While roof-bolting has played its part in the downward trend of roof-fall injury-frequency rates, its influence on the overall roof-fall-injury picture in 1955 was disappointing when one considers that the use of bolts in coal mines increased by one-third during the year. Notwithstanding all the attention that roof-bolting has received in recent years, the frequency rate of roof-fall injuries at bolted mines increased slightly. In fact, there were as many fatalities (five) from failures of bolted roof in 1955 as the total for 1948-54, inclusive, or since bolting has been widely accepted in the coal-mining industry.

The reason is that many mines are now bolting where the method is marginal in the sense that perfect anchorage cannot be obtained with the conventional bolt, yet the roof-fall accident rates in each of these mines show an improvement over that when conventional timbering was used. This means that our job is not complete if we are to obtain the maximum benefit from the method. We must improve the efficiency of such installations, and we must develop economically feasible warning devices. Some progress has been made in this direction but we are still far short of the point where such improvement and such devices are universally applicable with predictable results.

THE DANGER ZONE

Fourteen fatal accidents were reported in areas where roof-bolting was the accepted method of roof support, and all were within the 25-ft face zone where approximately three-fourths of all roof-fall injuries occur. In 9 of the 14 fatalities attributed to roof-bolted areas, the rock that fell was in the unsupported space between the last row of bolts and the face being mined.

To some extent, roof-bolting lessens the exposure from unsupported roof in this "danger zone," three ways:

1. Reducing the operations that must be performed under temporarily supported roof.
2. Reducing the average span between the permanent supports.
3. Stiffening the rock span between the last row of bolts and the face.

No responsible mining official, however, would suggest that safety props or jacks be eliminated in this area as long as there is a remote chance that

anyone will enter it to perform his work. However, many are killed by roof falls under such circumstances. Moreover, even "safety support" is often inadequate. In many instances, safety supports are installed in convenient spots rather than for maximum effectiveness.

Sometimes even the more-efficient and progressive mining companies which have adopted roof-bolting have accidents reflecting poor work habits that are hold-overs from conventional-timbering days. To illustrate, it is the practice in mobile-loading sections in one bituminous mine to set bolted cross pieces on 4-ft centers and not more than 3 ft from the face before cutting. The mining machine has a 9-ft cutter bar. Thus, the maximum unsupported span, after shooting and loading a cut, is 12 ft from the last row of bolts to the face.

The mobile loader had loaded out the cut, but during loading two small falls of roof occurred, which remained on the floor. The bolter and his helper entered the place with a hydraulically operated rotary drilling machine equipped with a lift for holding the crossbar in place while drilling. The bolter, leaving the machine and his helper under *supported* roof, entered the partly supported face area to test the roof. He pounded it with a pick and dislodged a rock slab that fell on him.

The place was supported according to a standardized plan, and all laws and company rules were being observed, yet the man was injured. Throughout the section even the bolted roof sounds drummy, but it is secure when properly bolted. The man was aware of this, yet he needlessly exposed himself in making roof tests in the belief that he was complying with the mine's rules and regulations.

REDUCED EXPOSURE VITAL

The company purchased this particular bolting machine so that operators need not expose themselves to unsupported roof while drilling, but officials did not follow up to see that full advantage was taken of the safety features of the machine. This accident suggests the following:

1. If further reductions are to be made in roof-fall injuries, the place to begin is in the "danger zone" within 25 ft of the face, where about 75% of the accidents of this type occur.
2. The way to attack the problem in the "danger zone" is to keep the permanent supports as close to the face as possible, and then eliminate exposure caused by unnecessary roof testing and other activities.

The statement that exposure of men

in the "danger zone" (the bridged area between the permanent support and the face) should be eliminated may seem impracticable, but it is being approached in several mines. It is well known that efficient mechanical loading is obtained by preparing the cut by good blasting practices or other dislodgment methods so that the loading machine can load with a minimum of digging. If the cut of coal is properly prepared, there is no need for the helper to go to the face during normal loading. The loading-machine operator and helper should work under permanent roof supports. Incidental rib coal is collected in loading the next cut.

Portable rotary and percussion roof-bolt machines are now being produced that have built-in safety features. These machines have booms or telescoping jacks to bear against the roof and serve as safety supports. With the use of these machines there is no reason for a bolting crew to work beneath unsupported roof. Certainly, there is no justification for a roof-bolting crew or even a foreman pounding on unsupported roof with a pick or bar, particularly when the roof is known to be bad. After a man tests the roof he has three choices: let it alone, take it down, or support it. When standardized support (either timbering or roof-bolting) is the rule and he must support it regardless of tests, his decision must be to take some roof down and then install supports, or support the roof "as is."

THE GOAL: NO EXPOSURE

Under normal conditions, the only excuse for anyone to go into the danger zone in a properly bolted or timbered mine is to test for gas. If some method of remotely testing for gas could be developed, this exposure hazard also could be eliminated.

When abnormal conditions occur which require work to be performed in the danger zone, safety posts or jacks should be liberally employed, and if a post or jack must be removed for maneuvering equipment, another post or jack should replace it. If workmen and foremen could be prevented from entering the danger zone under normal conditions and many of the safety posts and jacks now employed could be eliminated, then their use would be required only under abnormal conditions. The bureau recognizes, of course, that present rules and regulations require safety posts, but if the suggested objective could be obtained and exposure in this "no-man's land" eliminated, such rules and regulations could be revised accordingly, with benefit to the industry both in safety and efficiency.



FOUR COAL BEDS, totaling about 16 ft and spaced within 60-ft vertical interval, are mined at Tasa Coal's Peerless mine at Hookersville, W. Va.

Four-Seam Stripping



HILLTOPS like this one frequently are completely removed in recovering the coal. Tractor shovel rests on C coal, A and B coals are shown under ridge.

With multiple seams to recover in a definite sequence, the operation must run smoothly to avoid delays. Tasa relies on flexibility and close supervision to keep production rolling.

FOUR MINABLE BEDS of coal sandwiched between 63 ft of rock or less is not found very often at a mining property. But this unusual grouping of coal beds totaling 16 ft is found today at the Peerless mine of the Tasa Coal Co., Nicholas County, W. Va. Tasa is producing 1,800 tpd from a four-seam stripping operation that features flexibility and coordination.

Before the forces of nature wore away part of the coal deposits, there was a basin roughly 3 mi in radius where the beds were bunched close together. Of this area, about 90% has been carried away and only the small ridge tops remain. It is these peaks that are being leveled by Tasa to recover the four beds of coal.

The four beds are about 500 ft above the valley floor and dip 80 ft per mile to the northwest. Since the stripping ratio averages about 3 to 1, Tasa recovers nearly all of the coal. Maximum cover is as much as 170 ft, but only about 10% of the area is under this thick cover.

Geologically, the beds are believed to be the Kittanning coals. The top, or A, bed averages 72 in and has some small bands of impurities. A 20- to 45-in band of laminated coal separates the A and B seams. The B coal usually is only 18 to 20 in thick. Separating the B and C beds is a deposit of shale that ranges in thickness from 6 in to 15 ft. The thickness of the C coal varies from 42 to 54 in. A 6-in layer of shale separates the C and D coals. The D seam averages 40 to 48 in and has a thin parting that varies from 0 to 6 in.

Overburden is predominantly medium-hard sandstone, interlayered with shales. The main bed of sandstone is 30 ft thick and lies on top of 18 to 25 ft of shale covering the A coal.

DRILLING AND BLASTING

Drilling and blasting is a two-step job at Peerless mine. To prepare for the first step, an Allis Chalmers HD 21 bulldozer makes 300 ft of road at the back of the cut to be taken. Working at blade width, the bulldozer carves



BIG DRILL (left) bores holes in thick rock over four seams. Wagon unit (right) drills thin rock between coals.



STRIPPING SHOVEL handles main overburden covering all seams as well as thinner layers of rock between.

out an access road for the truck-mounted Davey vertical rotary drill.

After the road is completed, the two-man crew moves the drill into position on the road. The unit is mounted on a 4-wheel-drive GMC chassis. Drill stems are 15 ft long and 6¼-in holes are bored with J & D or North Dakota rotary bits. Holes are drilled on 15-ft centers along the roadway and to depths that will yield a 50-ft bench when the blasted material is pushed over the hillside. The slope of the mountain governs the depth of the blastholes.

While the drill operator makes a setup over a new hole, the helper usually loads the previously drilled hole. Each hole is charged with 12½ to 25 lb of du Pont or American Cyanamid 40% dynamite. All holes are detonated simultaneously with instantaneous blasting caps.

After the broken material is pushed over the hill and the 50-ft bench leveled, the drill crew sinks three rows of blastholes along the bench. Holes are spaced 12 ft apart in rows on 15-ft centers. The first row of holes is located 5 ft from the edge of the high-wall and serves as a base for locating the other two rows. Holes are drilled to within 1 or 2 ft of the top of the coal.

An average of 1 lb of explosive is needed to break each 2½ cu yd of overburden in the lower bench. Holes are connected with Primacord and du Pont 17-MS delay connectors are used between each row of blastholes. In some instances, MS delays also are used between holes within the rows.

UNCOVERING THE COAL

Removal of the main cover over the upper, or A, seam is done by a 5½-cu yd Lima 2400 that works around the clock, 6 days per week.



LOADING SCENE includes shovel loading B coal while tractor shovel and men clean pit. Stripping shovel in background is removing rock between seams.

Driven by a Caterpillar 397 diesel motor, the unit moves an average of 100,000 to 110,000 cu yd per month. In addition to handling the main overburden covering all of the seams, the shovel also removes a large portion of the partings between the beds of coal. Some of the rock between the coal seams can be removed without drilling and blasting. But the thicker and tougher material must be broken with explosives.

LOADING AND HAULING

Coal loading is a three-step process at Tasa's Peerless mine and requires close coordination between the 2½-cu yd P&H 1055 coal shovel and the Lima 2400.

Before loading starts, the top of the coal is thoroughly cleaned. Coarse material is removed either by a bulldozer, motor grader or tractor shovel and final cleaning is done by men with shovels.

The P&H unit first removes about 300 ft of A coal, exposing the carbonaceous shale over the B seam. This material is friable and can be dug without blasting. The job of removing it is assigned to the Lima 2400. Working the second and third shifts when coal is not loaded, the 5½-cu yd strip shovel removes the shale in one or two shifts per week, exposing the B seam. While the coal shovel is loading B coal on the day shift, the Lima unit normally uncovers more A coal or removes rock between the B and C coals.

The interval of rock between the B and C coals averages 7 ft in thickness and is hard; therefore, it must be broken with explosives. Blastholes are drilled on 9-ft centers with an Ingersoll-Rand wagon-mounted unit receiving air from a Gardner-Denver compressor. Both compressor and drill wagon are towed in and out of the pit by a Michigan 175A tractor shovel. An average of 4 lb of 2-in du Pont



STOCKPILE provides source of coal for cleaning plant in adverse weather or permits blending before cleaning.



PREPARATION PLANT featuring calcium chloride washing of 5x3/8 coal can process 150 tph of coal with 15% reject.



PEERLESS SUPERVISORS include John Fennel (left), superintendent; Harry Rippetoe, chemist; W. J. Hypes, office manager; and C. G. Griffith, pit foreman.



or American Cyanamid explosives is needed in each blasthole to break the rock sufficiently for easy removal.

The C and D coals usually average a total of 9 ft and sometimes are separated by a 5-in parting. When present, this impurity is loosened by the P&H shovel after the C coal is removed and then is pushed to the spoil area by the bulldozer. The D coal then is loaded. After the D coal is removed, the coal-loading cycle is started again on the A coal.

A fleet of 19 trucks carries the coal 5 mi over company roads to the preparation plant. Included in the haulage units are ten 17-ton Macks, four 14-ton Federals and assorted hired trucks. The road is level for about 4 mi, winds up the hill for 1 mi to the coal level and then follows the outcrop to the pit. Trucks travel on top of the coal after they enter the pit.

Coal is hauled either to one of three stockpiles or to two storage bins capable of holding 100 and 200 tons

each. This combination of storage facilities provides a source of coal for the cleaning plant in case bad weather slows trucks over the 5-mi haul. The large area available for stockpiling also permits coal from any of the beds to be stored separately if desired and blended in the bins before it is fed to the cleaning plant.

CLEANING THE COAL

Coal can be fed from either or both storage bins to a single-roll crusher and reduced to 5x0 before passing to the cleaning plant. A 30-in belt receives the crushed product and elevates it to the top of the plant where it is discharged onto an Allis Chalmers Ripl Flow vibrator and separated into 5x2, 2x1 and 1x3/8 fractions. The 1x3/8 drops onto a mixing conveyor and is carried to the loading points over railroad cars. The two larger sizes are carried to a shaking feeder and discharged into a split-box calcium chloride Belknap washer

equipped with an automatic density control.

Clean coal flows to a Hewitt Robins vibrator and is separated into 5x2, 2x1 and 1x3/8 sizes which drop onto the mixing conveyor. The 5x2 and 2x1 fractions are carried on the top strand and the 1x3/8 on the lower section of the conveyor. Either or both of the large sizes may be crushed to 1 1/4x0 before passing to railroad cars, or they may be loaded separately.

Operation of the 150-tph plant is handled by a crew of five men and a foreman. The present cleaning facilities were added to the plant in 1955. Plant design was handled by Fuel Process and construction was by Kana-wha Mfg. Co.

QUALITY CONTROL

Quality control rates top consideration at Peerless mine. A fully equipped laboratory located near the cleaning plant permits coal analyses to be made as quickly as possible.

Samples are taken from each railroad car and analyzed for ash and moisture content. A coke button also is made. For every shipment a composite analysis, including Btu, also is made.

Top executives of Tasa Coal Co. are: H. B. Salkeld, chairman of the board; P. H. Vestal, president; H. J. Collins, vice president, sales; R. E. Dougherty, vice president, operations; G. G. Garland, secretary and general counsel; L. D. Major, treasurer and comptroller; V. G. Holman, chief engineer.

Merle Busby is general superintendent of Tasa's West Virginia mines and John Fennel is superintendent of Peerless mine. Other mine officials include C. G. Griffith, pit foreman; Darius Cook, tippie foreman; Harry Rippetoe, chemist; and W. J. Hypes, office manager.

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FOREMEN'S FORUM



The Lesson in Moby Dick

An allegorical exercise on the importance of details

YOUR LOCAL THEATRE may soon be showing the new movie *Moby Dick*, a Warner Bros. release, which has received the acclaim of the critics. Sticking close to Herman Melville's great novel of the same name, the film tells of Captain Ahab's consuming hate for an albino whale which had inflicted degrading injuries upon him during a previous whaling voyage. Now Ahab leaves New Bedford to pursue the whale all over the seas until they finally meet in fatal combat.

The old-time whaler was a special breed of man. He could row up close to a 60-ton monster and fling a harpoon in its side, knowing full well that explosive events would occur the instant the harpoon struck. He was courageous to a fault. But success in whaling, measured in the number of barrels of whale oil laid down on the New Bedford wharves, depended upon more than courage. The

expert whaler also was noted for his attention to detail.

A call from the lookout, "There She Blows! She Blows!", raises a flurry and a shout on the decks below, as the crew turns from routine ship's duties to preparations for the chase. The shouting dies down, and as the ship bears down on the spouting whale, the boat crews are busily preparing to launch the whale boats. The 6-man crew forms alongside each whaleboat as it swings in its davits. Then at the captain's command the crews board the boats to be lowered over the side. The chase is on.

The long, narrow boat, pointed at bow and stern, contains thwarts for five oarsmen, the man at the bow oar being the harpooner. The sixth man, the boat commander, handles the rudder at the stern.

The oarsmen never turn their heads to

look at the whale on the tenable theory that the sight of the awesome mammal might panic the viewer or at least scramble his stroke. The boat commander at the stern is the only one to see the whale until the boat pulls up to within a yard or two of that special point in the mountain of flesh where the harpoon is to be placed, in back of the eye.

Now the boat commander orders the harpooner to rise and do his work. The harpooner turns and there is the towering whale, lying quietly, perhaps unable to perceive that the flimsy wooden crate alongside has the temerity to assault him. However, the harpooner does have the nerve, he does throw the harpoon and this particular portion of the sea begins to boil. Here is where attention to detail begins to count.

At the first sting of the harpoon the

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whale takes off, trying to throw the barb out of his body. The line attached to the harpoon has been carefully coiled in wooden tubs placed in the boat among the oarsmen. As the beast moves away, the line whips out of the tubs and sings out of the boat through a ring at the bow just inches from the arms and bodies of the oarsmen. As soon as possible, the line is snubbed around a loggerhead at the stern and now the "Nantucket sleighride" begins. The boat flies up and down the swells propelled by 50 tons or more of enraged muscle, blubber and guts. If the line had not been properly laid in the tubs, there is every chance that a flying loop might have snatched up an oarsman and whirled him to his death, or it might have snagged on the boat and parted the line. Thousands of dollars worth of whale oil thus would be lost, and these men are here for the oil.

Sooner or later the whale must pause for a breather. The boat is drawn up close again and now the boat commander and the harpooner change places, the harpooner taking over the rudder and the commander taking his place in the bow for the next detailed operation.

The commander picks up a lance and confidently thrusts it into the body of the whale to penetrate the creature's "lung." If the lance is properly placed—and it had better be—the tired, blowing whale drowns in his own blood.

But, there must be a less gory example of the importance of detail.

Consider our highways. As you see a ribbon of concrete stretching from the front wheels of your automobile toward the horizon, you may be moved to say, "A highway engineer's job must be nice. When his work is done he has this monument to show for his effort." However, there is more to his job than meets the eye. Here are some of the details he had to resolve.

In the first place, the route must be laid out with due consideration of (1) utility, (2) accessibility, (3) gradient, (4) drainage and (5) weather conditions. Each of these factors must have exhaustive study, and all this is preliminary to the real job.

With the route firmly established—only after endless discussion with proponents of alternate routes—the problem of securing easements and a legally clear right-of-way confronts the highway builder. This can be a painfully long and involved process in which attention to detail is of overriding importance. Any misplaced word or phrase can return to haunt the planners.

Now, construction contracts must be solicited and awarded. In this phase, detailed specifications must be set down to guide the contractors in their bidding.

Construction begins. The volume of material produced in cuts should be nearly equal to the volume required in fills. If enough material is not produced in this manner, the builder must locate a borrow pit offering suitable material within reasonable haulage distance. And if cut exceeds fill, he must find spoil room.

THE FARMER who bought the mule went back to the dealer and said, "You lied to me. I warmed the oats for that mule. I massaged him with a curry comb. I bedded him down at night. Yet he won't do a lick of work."

"Let me go out and have a look at him," said the dealer.

They went to the farm. The mule was standing there hitched to a plow. He wouldn't budge. The dealer picked up a two-by-four and broke it over the mule's head.

"Now try him," the dealer said.

"Giddap," the farmer said and the mule leaned into the harness and started off.

"I don't understand it," the farmer said. "I thought you said you had to treat him gently."

"You do," the dealer replied. "But first you have to get his attention."

—*Manage*, a publication of National Management Association.

He must concern himself with such seemingly minor matters as the character of rock used in the subgrade and its degree of compaction, the size-consist of the aggregate in the concrete and the quality of the sand, the thickness of the pavement and the spacing of its expansion joints. He must constantly check the "slump" of the mix, since this indicator of consistency is a forecast of the workability of the concrete. After the concrete is in place he must take steps to protect it from drastic changes in climate to insure a proper cure.

Guard rails are constructed and highway signs posted. Traffic lanes are laid out and the shoulders are stabilized. Finally the road is opened for our use, whereupon we see the monument but we seldom think of the headaches, frustrations and discouragement that arose in handling the numberless details.

We hope this makes you feel better.

You see, everyone is responsible for handling a burden of detail, even the monument builders. As a matter of fact, each of us builds a monument of one kind or another. It may be a respectable safety record or a healthy production record. We are reminded of the recurring story of the two bricklayers working side by side. A passing clergyman asked one of the men what he was doing, and the man replied, "I'm laying brick." The second fellow, in answer to the same question, said, "I'm building a cathedral." The latter viewpoint is the one we're trying to promote.

We have not forgotten Captain Ahab and the white whale. We shall return to them later, but right now let's look at your job.

The mine supervisor takes a back seat to nobody in his responsibility for handling numerous details. Taking a broad look, here are a few of your responsibilities:

Legal—Under the provisions of state

mining laws and the Federal code, you are legally accountable for the proper discharge of your responsibilities. This includes inspection of working places, maintenance of good ventilation, protecting the permissibility of electrical equipment, and so on. All are details, but mighty important ones.

Safety—Aside from major responsibilities for safety, the mine supervisor is called upon to concern himself with the details of proper protective clothing, good tools and even smokers' articles.

Personnel—The details of matching the skills of your crew to the jobs to be done can keep you busy. It's just too hot this afternoon to go any deeper into other aspects of human relations which also are your direct concern, but they are not few.

Production—A host of details surrounds this phase of your work. You must plan to get the most productive operating time with least non-productive tramping time out of each of your machines. The capacity and availability of transportation, where and when you want it, is a matter for constant, detailed study. Roof control, explosives economy, bit costs, rock-dusting, power distribution, size-consist, gas testing, line curtains, car spotters, fuses, pipe connectors, cap screws and a thousand-and-one other details must be attended in the supervisor's responsibility for production.

Communications—Numerous reports must be filed, maps brought up to date and messages transmitted, all requiring attention to detail for the sake of accuracy. Even a so-called minor phase of your total job encompasses a number of details.

Personal—After all these other duties have been properly discharged, there remains your responsibility to progress in your work. Off-the-job study, selective reading and mature reflection should be scheduled and that calls for some detail.

There is the hazard that one of these phases may begin to take precedence over all others. For example, accent on production for the sake of tonnage alone, however laudable this may be, can lead to dire consequences, economic and otherwise. Pushing too hard for tonnage at the neglect of maintenance can rebound in increased downtime, higher costs and lower tonnage, just the opposite of what was hoped for. Or, safety may suffer when production becomes an obsession, with one of the men or the foreman himself becoming the victim of this policy.

Possessed by his hate, Captain Ahab had only one thought in mind; that was, killing his enemy, the whale. He reached the big moment when he finally came to grips with Moby Dick. But his obsession with only one phase of his total responsibilities caused him to forget the details of his own safety. The white whale destroyed him. That is the lesson of Moby Dick.



SERVICE-SCORE STICKERS provide valuable wire rope facts

... to test performance, speed reordering

For efficient wire rope operation you must have wire rope facts—brief, handy, accurate facts. You need them for safety (when did that line go on?). You need them for reordering (what size is the hoist line?). And you need them most of all for figuring cost (how long did it last?).

But gathering wire rope facts can be time-consuming—unless you have an easy, simple system.

Leschen's Service-Score Stickers provide such a system. The facts are always at hand—on the machine while the wire rope

is working, and in the record book from then on.

Service-Score Stickers make it easy to compare the service you get from various rope constructions, types, and brands, so you *know which one is best* for you.

With the Service-Score System you prove to yourself that Red-Strand wire rope consistently exceeds industry standards for strength and safety.

Write for your starting supply of Service-Score Stickers now—or see your Leschen distributor.

**LESCHEN WIRE ROPE
SERVICE-SCORE**

Equip-
ment _____

Make _____

Equip.
No. _____

Line _____

Rope
Length _____

Rope
Diameter _____

Con-
struction _____

Brand **Red-Strand** _____

Brand _____

Reel
No. _____

Date
Installed _____

Date
Removed _____

Service
in Hours—Yards—Tons—Miles _____

Keep the score
and you'll use it more
**RED-STRAND
WIRE ROPE**

LESCHEN

**Red-Strand
WIRE ROPE**

Keep the score and you'll use it more—Red-Strand Wire Rope

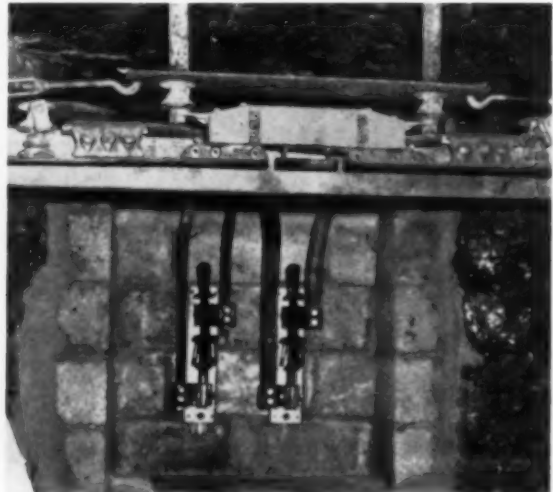
**LESCHEN WIRE ROPE DIVISION
H. K. PORTER COMPANY, INC.
St. Louis 12, Missouri**



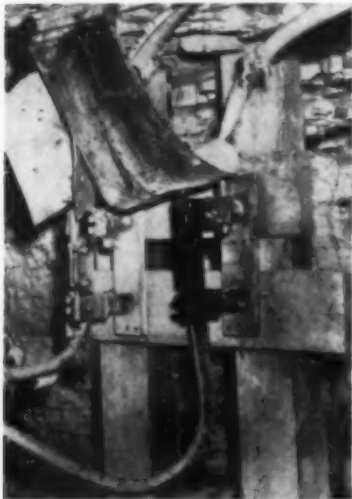
OPERATING IDEAS



STURDY PIPE FRAME holds feeder safety switch within easy reach where rib mounting would be impractical.



GUARD BOARD protects section insulator; quick-break switches in fireproof recess in rib are well protected.



RUBBER FLAPS assure longer life for blades and contacts by keeping dust out of quick-break switches.



WOOD HOUSING protects switch parts from elements and permits switch to be locked, opened or closed.



FEEDER SWITCH is protected against dust by rubber flap that fits snugly over top of case and terminals.

Tips on Better Switch Installations

IT PAYS to take some pains in mounting or installing electrical switches. Why? Because they will last longer and give trouble-free operation if rock and coal dusts are kept out of switch blades and contact jaws. And good installations offer

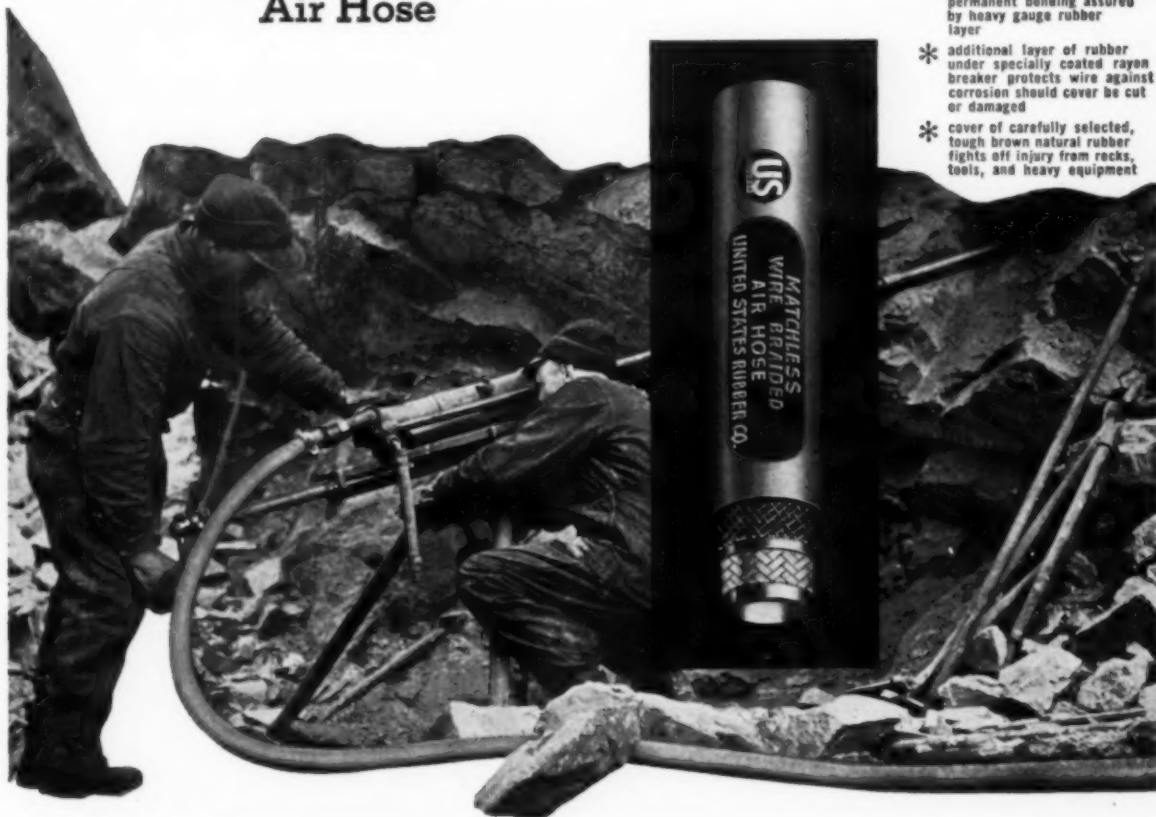
an extra measure of safety for the man who operates the switch.

Here are five examples of good installations that appeared in *Haulage Ways* recently. Some are more elaborate than others and require extra time, labor and

materials. Others are simple, inexpensive and require only a few extra minutes. Check through the group to see if your mine can benefit from the same types of installations. Longer life and increased safety are among the benefits you get.

**HANDLE
WITH
ABANDON!**

U. S. Matchless Wire Braid Air Hose



No "babying" needed here! U. S. Rubber Engineers designed this premium quality hose with more than enough brute strength and stamina to withstand the highest working pressures, the toughest construction conditions.

And U. S. Matchless® has *proved* its ability to take both use and abuse *indefinitely*—on jobs around the world—serving long after ordinary hose has been ruined by abrasion, crushing and high pressure.

Yet in spite of its great strength, U. S. Matchless is highly flexible—practically as easy to handle as a garden hose.

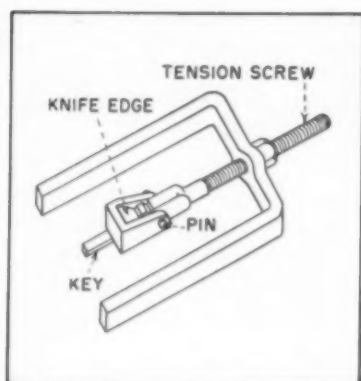
Mandrel-made, wrapped-finish U. S. Matchless Wire Braid Air Hose is available in 50 ft. lengths from any of our 28 District Sales Offices, or by writing to us at Rockefeller Center, New York 20, N. Y. *Whatever* your hose requirements, it *pays* to turn to "U. S." There's a job-engineered U. S. Hose for practically every purpose—a staff of "U. S." Engineers to assist you in your hose selection.

- * tube of high quality neoprene is completely resistant to line oil
- * special steel wire braid gives tremendous strength, permanent bending assured by heavy gauge rubber layer
- * additional layer of rubber under specially coated rayon breaker protects wire against corrosion should cover be cut or damaged
- * cover of carefully selected, tough brown natural rubber fights off injury from rocks, tools, and heavy equipment



Mechanical Goods Division

United States Rubber



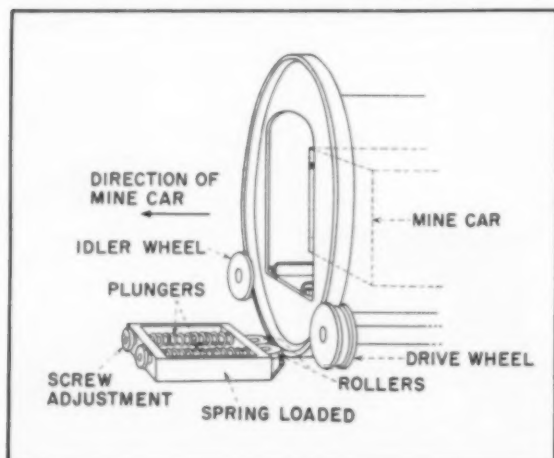
Extractor Speeds Key Removal

REMOVING TIGHT KEYS which lock pulleys to shafts is no problem at the Markham Colliery, according to recent issue of *Iron and Coal Trades Review*. Designed by F. Newbold, washer operator, the device is proving useful not only at the cleaning plant but also at other installations where there is no shop. The tool consists of a U-shaped steel forging; a tension screw which passes through a hole bored in the bar; a smaller U-shaped forging with a knife edge to grip the key. The knife edge is attached to the forged-steel head of the tension screw by a high-tensile steel pin. Force is applied to the

key, through the bolt, by turning a nut which is placed on the tension screw on the far side of the main U arm.

To operate the device, the jaws of the U-shaped arm are placed in position up to the hub of the pulley and the forged head of the tension screw is placed under the key. The knife edge, which fits over the key head, is then placed in position and firmly attached to the head of the tension screw by the steel pin. If the key is flat, a cut must be made to take the knife edge. The adjusting nut is turned with a spanner to exert a steady pull until the key is free.

Absorber Saves Rotary Dump

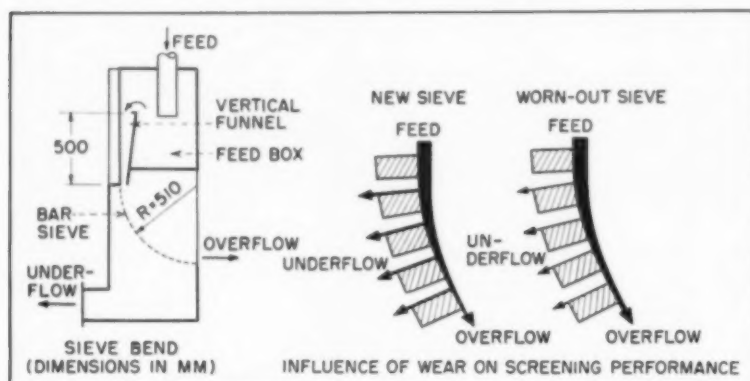


WEAR AND TEAR on drive and idler wheels on a rotary dump have been eliminated by installing a shock-absorbing device, according to an article in a recent issue of *Colliery Guardian*. The device is designed to take up the shocks given to the drive and idler wheels by mine cars entering too rapidly. After 18 mo of operation with the shock absorber, no appreciable wear or deterioration of drive and idler wheels on the dump was noted. Before the units were installed, wheels had to be replaced after 1 mo of service.

Essential parts of the shock absorber are a roller head that fits against the dump ring, adjustable spring-loaded plungers and a steel housing. Units are mounted at each end of the dump. The one at the end taking the main thrust of the cars has two roller heads and two plungers, whereas the absorber taking the recoil has only one roller and plunger.

Springs are made of 13/16-in material and have 4-in O. D. and 2 3/4-in I. D. Pitch is 1 1/4 in and the free length of the spring is 16 in. They are fitted over 2-in-diameter plungers attached to the head bracket which carries the 7-in-diameter rollers.

The head bracket can be moved 3/4 in on the springs by turning the adjusting screws. Thus proper clearance can be maintained between the drive and idler wheels and the large-diameter dump ring. With this clearance maintained, the shock is transmitted to the absorber device rather than to the drive and idler wheels.



Curved Screen Deck Boosts Efficiency

SEPARATING wet fines to a definite particle size, screen capacity independent of the concentration and particle size of the suspension, and capacity 20 times greater than a vibrating screen are benefits claimed for a curved screen deck devel-

oped in the Netherlands. Dr. D. W. van Krevelon, director of research, Central Laboratory, Staatsmijnen, Geleen, said that with the device, wet coal fines can be separated to a definite particle size, which previously could be done only after the

product had been dried beforehand.

A suspension of the material to be sized is passed along a curved screen deck made up of steel bars about 2 mm wide and spaced about 1 mm apart. As material flows over the screen, each bar scrapes off a thin layer of water about 1/4 mm thick, which may entrain coal particles up to 1/2 mm in diameter. The bar sieve is curved to ensure that an uninterrupted layer of the suspension will remain in contact with the screening deck.

Since the 1-mm slots make a cut at 1/2 mm, the slots cannot block up. This makes the capacity of the sieve device independent of the concentration and particle size of the suspension. The volume to be treated in a given time is the only consideration.

Another unusual feature of the sieve is that the separation is made to a smaller size as the bars are being worn away. This is because the thickness of the "peeled-off" water layer decreases. The performance of the worn-out sieve can be restored to its original state by simply reversing the screening deck. This is done every 10 days. Total life of the deck is about 4 mo, in which period about 300,000 tons of suspension have been handled over the screen.



Wire Rope at Work—This monster, which looks like a cross between a battleship and a dragon, can scoop up 22 yd of earth at a single pull of the bucket. Its insatiable appetite for rock and dirt is its greatest asset, especially in stripping large areas where the overburden is thick.

The huge excavator would get nowhere, of course, without the wire ropes that drag and hoist the bucket. On this job, Bethlehem Purple Strand was used for both applications—2¼-in. 6x25 for the draglines, 1¾-in. 6x41 for the hoist lines. Whopping big cables, particularly the drag ropes; even in the roughest kind of going, they put "hustle" in the job. Ropes like these can move that bucket all day long and still be ready for more.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING



EQUIPMENT NEWS



Unit Drills 700 TPD

A continuous mining unit that is capable of drilling out 700 tpd of coal from 50-in holes is being produced by the Cardox Corp., 307 N. Michigan Ave., Chicago 1, Ill. Named the Cardox Auger Miner Model 235, the unit operates with a three-man crew and is in use at strip mines where excessive overburden makes further conventional stripping unprofitable. The model, incidentally, is the largest in the Cardox line. The company says that the 235's "unusually rugged construction provides the power and stability needed to handle its 48-in augers and high rate tonnage." In addition, says Cardox, new features reduce idle time to a minimum and permit virtually continuous mining.

The 235 is self-positioning vertically and self-moving horizontally from hole to hole by means of three sliding shoes. It does not require rails, skids and separate power. In operation it spans the space of two holes. After the first hole has been drilled out for a distance up to 200 ft or more the 12 ft auger lengths are retrieved one at a time. The completed hole then serves as storage for the augers and lessens the overall time needed to retract and connect augers to be used to drill the next hole.

Despite the large size, says Cardox, the 235 works easily in a 26-ft pit or shelf. Overall length is 20 ft, 2 in. Width is 12 ft, 6 in, plus a 51-in overhang of monorail for the auger hoist. Height is 14-ft, 7½ in in high lift position. Mined coal is brought out ready for loading directly into trucks by portable elevator conveyors.

Holes may be drilled one above the other in thick seams and a hydraulic vertical directional control keeps the augers drilling into the best part of the seam away from shale or other impurities.

Power for drilling is provided by a 235 hp diesel delivering 650 ft lb of torque at 1,000 rpm—sufficient to handle readily the 48-in drills, according to Cardox. A separate 65 hp diesel is used with the hydraulic system for such functions as raising or lowering the unit within a range of 6 ft on elevator posts, operating

the auger hoist and retriever and moving the machine on its sliding shoes, either parallel with or at 90 deg to the high wall.

The entire unit, says Cardox, has been designed for easy maintenance with a minimum of disassembly.



Light To Medium Tractors Announced

A line of light and medium-duty utility tractors, the M-H-F "WORK BULLS," and allied equipment has been introduced by the new Industrial Div., Massey-Harris-Ferguson, Inc., Quality Ave., Racine, Wis. The line consists of five tractors and a number of attachments. The tractors are designed, according to the company, "to fill a gap between light and heavy equipment in three areas; as primary equipment on small work-and-run jobs; as back-up machines for medium and high-priced single-purpose equipment; and as versatile clean-up and utility tools."

The 20 hydraulically controlled attachments offered with the line are designed to provide a job-matched tool for a wide

To celebrate its first birthday

THE D9 GETS INCREASED HP

—more power for your operation!

320 HP

(FLYWHEEL)

formerly 286 HP

260 HP

(DRAWBAR)

formerly 230 HP



The giant Turbocharged CAT* D9 Tractor, which since its introduction last year has set new performance standards in the field, now packs more power than ever to handle even bigger jobs. Its drawbar capacity has been increased from 230 HP to 260 HP—its flywheel horsepower from 286 to 320!

This increase in power reflects Caterpillar's policy of leadership in action. Combining research with practical field experience, there's constant product improvement to meet your needs for bigger production at lower cost. This policy applies to every product in the Caterpillar line—Diesel Engines, Tractors, Motor Graders and Earthmoving Equipment.

Now, with its increased horsepower, you can give the D9 tougher jobs than ever before. To match your requirements, it's available with torque converter or direct drive with oil clutch. For complete details about the more powerful D9, see your Caterpillar Dealer. Name the date—he'll be glad to demonstrate!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

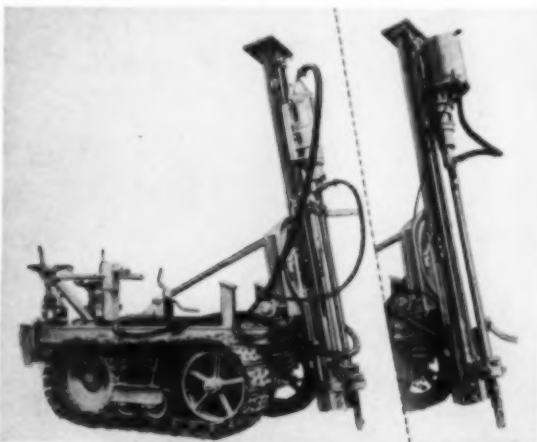
**D9—MORE POWERFUL
FOR BIGGER PRODUCTION**

variety of tasks such as digging, loading, lifting, dozing, trenching, grading, materials handling and mowing.

The biggest tractor in the new line is the Model 404 (illustrated). Delivering 52 hp with its 277-cu in, high-torque engine, the 404 handles the larger bucket attachments, loaders and hoes. With a $\frac{3}{4}$ -yd front-end loader (photo), it has a 3,500-lb breakout capacity, a lifting height of 10 ft, 6 in and a dumping height of 8 ft, 6 in. In addition to hydraulic control of both tractor and attachments, the 404 features a five-speed transmission, gear-driven differential, heavy-duty front axle and support, worm and sector steering (power steering optional), heavy-duty clutch, full-pressure lubrication and a 12-v electrical system. A diesel and power take-off are available as optional equipment.

The remaining models are the 202 (34 hp, speeds to 15 mph, bucket load 9 to 11 cu ft, forklift capacity 2,000 lb, 12-v electrical system); the 303 (42 hp speeds to 15 mph, $\frac{3}{4}$ yd loader capacity, backhoe bucket sizes 12 to 36 in) the Davis Pit Bull (gasoline engine delivers 42 hp, designed to replace and outwork high-priced, single purpose machines); and the 202 Forklift (based on the 202 in reversed position with load over large drive wheels).

Attachments being offered with the line are the Davis 185 Backhoe, the 500 Loader, an angle dozer, a forklift attachment, utility boom, scarifier, Davis 102 loader and broom or sweeper.



West German Drill

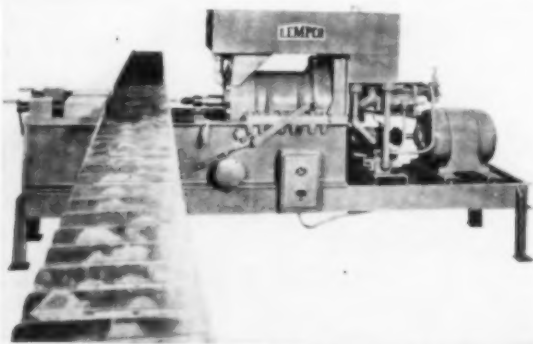
A rotary rock drill developed in West Germany by Maschinenfabrick Rudolf Hauscherr & Soehne is being distributed in the United States in two versions—pneumatically-powered (DK-9) and electrically-powered (E-9). The distributor, B. J. Nykerk Corp., 42 Broadway, New York 4, N.Y., recommends the machine for drilling in coal. Relatively portable (drill and slide weigh a little over 900 lb), the unit uses jointed drill steel with tungsten-carbide bits and is capable of drilling bore holes up to 11.8 in in diameter. A report from West Germany indicates that the DK-9 sustained an average penetration rate of 22½ ft per hr in a 4-in borehole in tough limestone. The drill has been used either truck-mounted or on Hauscherr's self-propelled pneumatically-driven caterpillar-type drilling carriage. It may be used independently for drilling low horizontal holes, or in conjunction with a drilling mast for vertical holes.

Convertible Excavator In Production

Koehring Co., Milwaukee, Wis., has launched production of its Model 1205 excavator, latest and largest being built by Koehring. The 1205 is listed in the 3 cu yd dipper capacity class and has, according to the company, an established lifting capacity of 95 tons at 75% rating. Standard shovel attachment combines a 30-ft boom with 22-ft dipper sticks. For the crane the basic 60-ft alloy steel boom can be extended to a maximum 180-ft—plus an additional 30-ft of jib boom. The 1205 is fully convertible from shovel to lift crane and dragline or clamshell



operation, handling buckets of 3 to 4 cu yd capacities, depending on digging conditions. The machines weight is 179,360 lb with a standard shovel, 197,015 as a crane with a 60-ft boom.



Installs, Removes Track Pins, Bushings

Lemco Products, Inc., Bedford, Ohio, has introduced a track pin and bushing press for removal and installation of crawler track pins and bushings. Designated the 565 Powermatic, the press (with special tools and adapters) will service tracks from the smallest to largest models of Allis-Chalmers, Caterpillar, Euclid, International and Oliver tractors. Centralized controls permit an operator to do the complete job of pressing bushings and pins both in and out. Equipped with an automatic pressure-controlled ram head and a recessed ram nose, the 150-ton hydraulic unit has two ram speeds—180 in per minute up to 30 tons pressure and 30 in per minute over 30 tons. For shop use a stationary model is electrically powered—for field use a wheel-mounted model with trailer hitch is powered by a gasoline engine.



Medium Scraper Introduced

Allis-Chalmers, Tractor Group, Milwaukee, Wis., has introduced the TS-260 motor scraper, a 200-hp, medium size unit

There's
MORE

rating selection available in Allis-Chalmers **MOTORS**

To meet mining needs...
**Allis-Chalmers Offers Complete Line
of Rib-Type MOTORS
from 1 to 100 Hp**



Allis-Chalmers, a pioneer in rib-type TEFC motor design, is the only leading manufacturer offering a complete line of these motors from 1 to 100 hp. The many cost-saving features of deep-rib construction can be applied in a variety of uses... both indoors and out.

Here's why these motors can cut mining costs:

MORE cooling surface — Rib-type design provides reserve cooling capacity in dirty locations.

MORE iron—Cast-iron frame and external parts assure rigidity and resistance to corrosion.

MORE copper — Allis-Chalmers greater use of copper increases electrical life.

MORE lubrication provisions — Large grease reservoirs surround bearings. Provision made for in-service relubrication — important where moisture or corrosive vapors contaminate grease.

As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby Allis-Chalmers distributor, district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-4939

ALLIS-CHALMERS



weighing 39,600 lb. Powered by a six-cylinder diesel, the scraper has a 14 cu yd heaped capacity, an 11 cu yd struck capacity and will haul an 18-ton payload. Other features: a hydraulic pump, gear-driven from the rear of the engine crankshaft, to provide drive and power for steering and scraper operation; a curved bottom and three-piece cutting edge with an offset center edge; and a high apron lift. When empty 66% of the scraper's weight is carried on its tractor wheels; when loaded an equal amount is supported by each tire. Allis-Chalmers also points out these engineering features: the diesel can be removed without removing the transmission; the clutch can be removed without removing the engine.

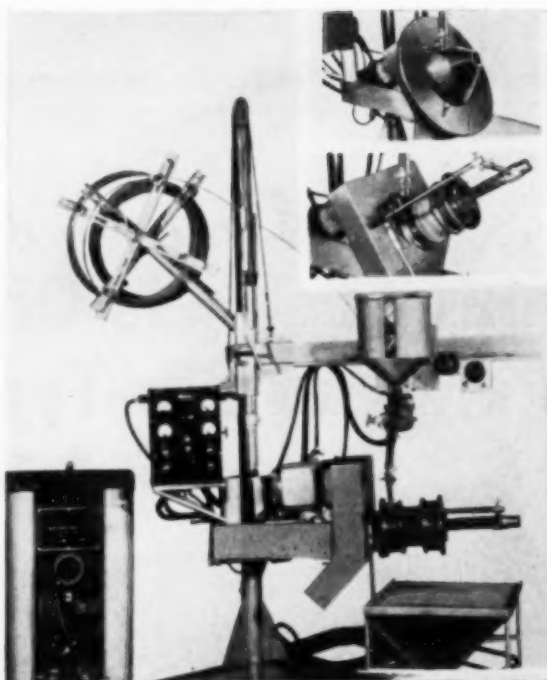


Pint-Sized Rail Car Shunter

A single-wheel railroad car shunter equipped with a one-cylinder, 6-hp engine that will move cars with a total weight to 100 tons is being distributed in the United States by the Railroad Car Shunter Corp. of America, Woolworth Bldg., New York 7, N.Y. Manufactured by ILO-WERKE G.M.B.H., Munich, West Germany, the pint-sized shunter can be operated by one man. It weighs 550 lb and its air-cooled, two-stroke motor delivers 6-hp at 3,000 rpm. The manufacturer says the shunter will traverse rough ground, climb and cross rails, switches and sleepers under its own power. It can be set on a rail between railroad cars and its operator can guide it from the side of a car or from behind.

Unit Permits Automatic Welding

A "packaged" welding unit engineered for automatic welding on circular shapes such as rolls, idlers, sheaves, crusher rolls, but also designed for longitudinal weldments has been developed by the Sight Feed Generator Co., West Alexandria, Ohio. Named the Rexare RP-43 automatic roll and idler welder and positioner, the unit is designed to operate on higher than normal welding voltage to attain higher torque and faster speed response. Wider changes of rod feed rate permit a variety of rod sizes and compositions without changing gearing. The rod feed motor, designed for 110 v, is barely affected by arc voltage variation, according to the company. Work pieces are simultaneously rotated with the arc's stopping and starting. A speed range of



.13 to 1.33 rpm permits building up the smallest roll to the largest weldment at the correct welding speed. In addition, a 120 deg tilting table permits, for instance, building flanges on rollers.



Car Designed To Clear Rail Jacks

The Nolan Co., Bowerston, Ohio, has announced a basic change in a tool and supply car it began marketing several months ago. To facilitate unhampered movement of the vehicle on the job the company has redesigned the car's wheels to clear track jacks when necessary. Other features that have been retained are the car's 2,000-lb capacity, its tubular steel construction and its center-breaking design that permits it to be handled in sections.

Breaker Gives Dual Protection

A dual-rated circuit breaker designed to protect equipment operating on either of two different voltages—e. g. 6 and 12 v DC or 110 and 220 v AC—is being produced by the Heinemann Electric Co., Trenton, N.J. The breaker has two ratings (2 and 4 amp or 5 and 10 amp, etc.) with separate load connections



Speed — Strength — Smooth Underrun! O-B HOLLOW SCREW SPLICERS

Speed—Two-piece clamp body slips easily over burrs and kinks to join any size wire from 2/0 to 6/0 Grooved, Figure 8, or No. 9 Section.

Strength—Four hollow bronze screws clamp body tight, two angled set screws hold wire.

Smooth Underrun—Trolley wire itself is the underrun! When splicing different size wires, sim-

ply file down the larger one to preserve that smooth underrun.

Speed—Strength—Smooth Underrun—you always get all three when you standardize on O-B hollow screw fittings for your overhead.

Order Catalog No. 22270 for the splicer shown above.



O-B Hollow Screw Combination
Feeder-Trolley Clamp

O-B Hollow Screw
Trolley Clamp



Ohio Brass
MANSFIELD  OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Feeder and Trolley Materials • Control Materials • Trolley Shoes
Roof Bolt Shells and Plugs • Rail Bonds • Automatic Couplers



- 1 NEW— $1\frac{3}{4}$ " stop.** Prevents bit from being jammed in the lug. Assures accurate positioning.
- 2 NEW—Radiused nose.** Provides maximum clearance for shank. Gives cleaner, easier cutting action.
- 3 NEW—Stronger carbide tip.** Brazed on three sides to resist severest strains.

New design features, plus gauge stop to prevent jamming in the lugs . . .

New Carboloy CCS-1 Medium-Duty Bit gets more tonnage at lower bit cost

The new Carboloy® CCS-1 has all the economy advantages of the rugged Carboloy CC-1 . . . plus a few more of its own.

The CCS-1 Medium-Duty Bit has a $1\frac{3}{4}$ " stop to prevent jamming in the lugs. It uses a new radiused nose design for smoother, freer cutting action. And, it has a carbide tip that can take any cut in stride.

Cutting machines tooled with the CCS-1 produce more tonnage per shift—because it cuts easier, stays sharp longer. Machines draw less power—because CCS-1 uses the same narrow cutting edge and top rake angle that

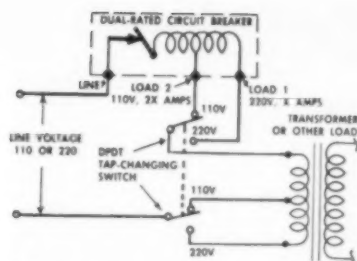
made the CC-1 so economical to operate.

The CCS-1 is designed to give regrind after regrind, under all types of conditions. It can be used in all machines using $\frac{1}{2}$ " x 1" bits.

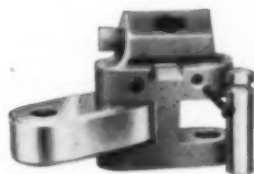
This bit, like all the tools in the complete Carboloy line, is locally stocked for immediate delivery. For prices, specifications, or expert assistance on carbide tool problems, call your Authorized Carboloy Mining Tool Distributor. You'll find his name listed on the opposite page. Or write: *Metallurgical Products Department of General Electric Company, 11120 E. 8 Mile Street, Detroit 32, Michigan.*

"Carboloy" is a trademark of General Electric Company

CARBOLLOY
CEMENTED CARBIDES

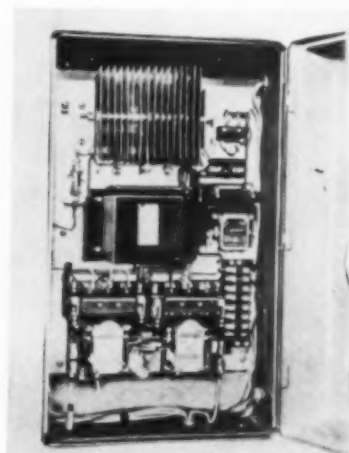


for each rating. Although most of the ratings being made thus far have current ratios of 2 to 1, the company says it can manufacture breakers with current ratios of up to 4 to 1. Minimum and maximum ratings are 1 amp and 40 amp. Because of its hydraulic-magnetic operation, the circuit breaker's ratings are unaffected by ambient temperature. Dual-rated circuit breakers are available with one of three inverse time-delay characteristics or in an instantaneous-trip form. Maximum voltage is 480 AC; 125 DC.



Hand-Tool Assembly

A trimmer chain manufactured with a coupling pin design that permits the chain to be assembled or disassembled with small hand tools is being produced by the Bowdill Co., Canton, Ohio. Designed for all makes of boring type continuous miners, the chain's pitch may be varied by changing couplers. Bowdill throwaway or 1/2- x 1-in shank bits are used with the chain.



Electric Motor Controller

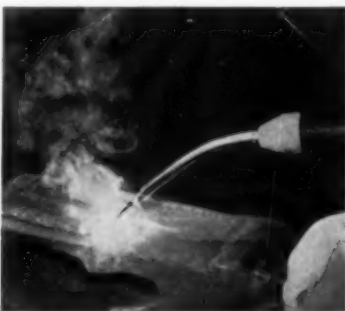
An electric controller, or brake, for AC motors is being manufactured by the Westinghouse Electric Corp., 3 Gateway

Center, Pittsburgh 30, Pa. Named "Dynac," the unit reportedly stops AC motors in seconds. Westinghouse points out that machinery damage can be avoided in the event of jam-ups. Self-contained, "Dynac" requires no special motors, shaft extensions, mechanical braking devices or special windings. Other features: virtual elimination of current loss; precise motor overload protection.



Indicator Light Test

A "push-to-test" oil-tight indicating light available from Westinghouse Electric Corp., Standard Control Div., Beaver, Pa., permits a check to determine whether an unlit indicator lamp is an indication of trouble or merely the result of lamp failure. By pressing the lens of the new indicator light, an operator transfers the lamp from its normal circuit to a separate built-in lamp test circuit. If the lamp is functioning it will light normally to indicate that trouble-shooting is in order. If it fails to light, the lamp should be replaced.



Tube Rod Electrodes

A line of "tube rod" electrodes developed for semi-automatic hardfacing has been announced by the American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill. The electrodes are 3/32-in diameter, drawn tubular wire and, the company says, will yield high metal deposition and longer wear life. Although the rods have been designed for use with the AMSCO MF semi-automatic welder, they can be adapted for use with most semi-automatic machines. Their tubular construction permits them to be driven by feed rollers found in semi-automatic welders.

(Continued on p 108)

Carboloy Mining-Tool Distributors

Your local Carboloy Mining-Tool Distributor is listed below. His complete stocks guarantee you immediate local delivery.

ALABAMA

Birmingham 2—Shook & Fletcher Supply Co.

COLORADO

Denver 17—Mine & Smelter Supply Co.

ILLINOIS

ML Vernon—Central Mine Supply Co.

INDIANA

Terre Haute—The Mine Supply Co., Inc.

KENTUCKY

Harlan—General Electric Supply Co., Div. of General Electric Distributing Corp.

Harlan—Kentucky Mine Supply Co., Inc. Madisonville—Central Mine Supply Co.

Paintsville—Farmer's Supply Co. Pikeville—Big Sandy Electric & Supply Co., Inc.

NEW YORK

Buffalo 23—Austin Ford Logan, Inc.

OHIO

Cambridge—Cambridge Machine & Supply

OREGON

Portland—J. E. Haseltine & Company

PENNSYLVANIA

Johnstown—General Electric Supply Co., Div. of General Electric Distributing Corp.

Pittsburgh—General Electric Supply Co., Div. of General Electric Distributing Corp.

Washington—Fairmont Supply Co.

TENNESSEE

Knoxville—Crowell Engineering & Sales Co. Knoxville—W. J. Savage Company

TEXAS

El Paso—El Paso Saw & Belting Co. El Paso—Mine & Smelter Supply Co.

UTAH

Salt Lake City 1—Mine & Smelter Supply Co.

VIRGINIA

McClure—Erwin Supply & Hardware Co.

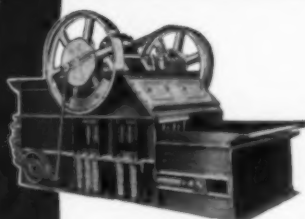
WEST VIRGINIA

Bluefield—Bluefield Supply Co. Bluefield—Rish Equipment Company Charleston—Rish Equipment Company Clarksburg—Rish Equipment Company Fairmont—Fairmont Supply Company Montgomery—Marathon Coal Bit Co. Shinnston—Erwin Supply & Hardware Co.

CARBOLOY
CEMENTED CARBIDES
Detroit 32, Michigan

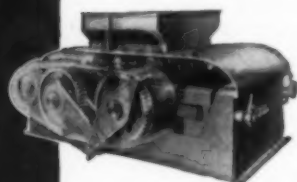
America's most complete line of CRUSHING EQUIPMENT

AVAILABLE
FROM STOCK
AND SHIP-OR-DELIVERY



McNally Norton Vertical Pick
Breaker

50% less fines when reducing
lump to egg and stove sizes.



McNally Double Roll Gearmatic
R. O. M. Breaker

Built in tonnage ranges from
750 tph to 1400 tph. Full float-
ing Gearmatic drive.



McNally Gearmatic Stoker Coal
Crusher

This unit offers three prime ad-
vantages:
High volume production, plus
accurate sizing, plus low per-
centage of fines.



McNally Single Roll Crusher

Universal application. 20", 24"
and 36" dia. rolls.

For immediate action on com-
plete information write, wire or
call . . .

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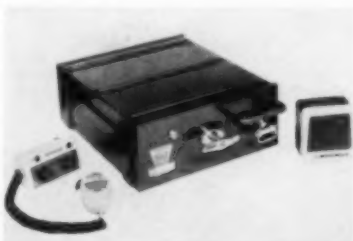
★ Pittsburg, Kansas ★
★ Wellton, Ohio ★

Equipment News (Continued)



Motor Control Center

General Electric Co., Distribution As-
semblies Dept., 41 Woodford Ave., Plain-
ville, Conn., is marketing the general-
purpose motor control center, Type
DA7093, which, the company says, is
designed for economical, centralized con-
trol of AC motors, 1 to 200 hp, 110 to
600 v, 3 phase. The company points out
these features: since all control opera-
tions are grouped in one location, instal-
lation and servicing are simplified; stan-
dardized "drawer-like" replacement
control units are available and a spare can
be inserted quickly. GE also points out
that the center is equipped with door-
locking devices, split-type terminal blocks,
pull-box space, center busing, continuous
ground of the unit's frame, large wiring
gutters and silver-plated copper stab con-
nections.



100-W Mobile Radio

A mobile two-way radio rated at 100 w
transmitter power output on any channel
in the 25-54 megacycle frequency band
has been announced by Motorola, Inc.,
Communications & Electronics Div., 4501
W. August Blvd., Chicago 51, Ill. The
radio incorporates a new dynamotor-vi-
brator power supply which, at a power
intake equivalent to conventional 60-w
mobile radios, provides full-rated trans-
mitter output. The transmitter is capable
of 4-channel operation with each fre-
quency crystal-controlled.

Lightweight Rock Drill

A lightweight rock drill powered by a
gasoline engine drills up to 26 ft per hr



through hard granite, according to the
manufacturer, Atlas Copco Eastern, Inc.,
San Carlos, Calif. Named the Cobra
Motor Drill and Breaker, the unit weighs
53 lb. A floatless carburetor permits drill-
ing in all positions from straight down to
45 deg upward and to 13 ft.

Valve Change Speeds Drill

A faster, stronger rotation resulting in
increased drilling speeds and hole footage
has been achieved in the Le Roi-Cleve-
land H-10 sinker drill, according to the
manufacturer, Le Roi Div., Westinghouse
Air Brake Co., Milwaukee 1, Wis. The
use of a valve of the type used in the
company's H10 AL air leg drill is re-
sponsible for the change. By increasing
the metering limits of the valve and the
valve block, fast drilling speeds are possi-
ble since valve travel is extremely short.
The new valve and valve block are inter-
changeable with those previously used in
the H-10 sinker drill.



Ripper Speeds Bucket Work

Designed especially for speeding up
bucket loader operations, a ripper being
manufactured by the Hensley Equipment
Co., Inc., 800 Peralta Ave., San Leandro,
Calif., clamps directly to the lower lip of
any standard bucket loader. The unit con-
sists of two ripper teeth rigidly mounted
12 in apart by three 1 1/4-in steel spacer
bolts. The teeth are equipped with re-

Those Who Use Them...Choose Them Again



ROTARY

BLAST HOLE DRILLS

In December, 1952, the Maumee Collieries Co., Terre Haute, Indiana, put the first Bucyrus-Erie 50-R into operation. So outstanding were the footage records of this drill that the company has since added three more.

BUCYRUS-ERIE rotaries are available in two sizes — the 40-R (equipped with either diesel-electric or full electric power) for drilling 6¾- to 9-in. holes, and the 50-R (electric only) for drilling 9¾- to 12¼-in. holes. For the complete story on these drills, write today to —

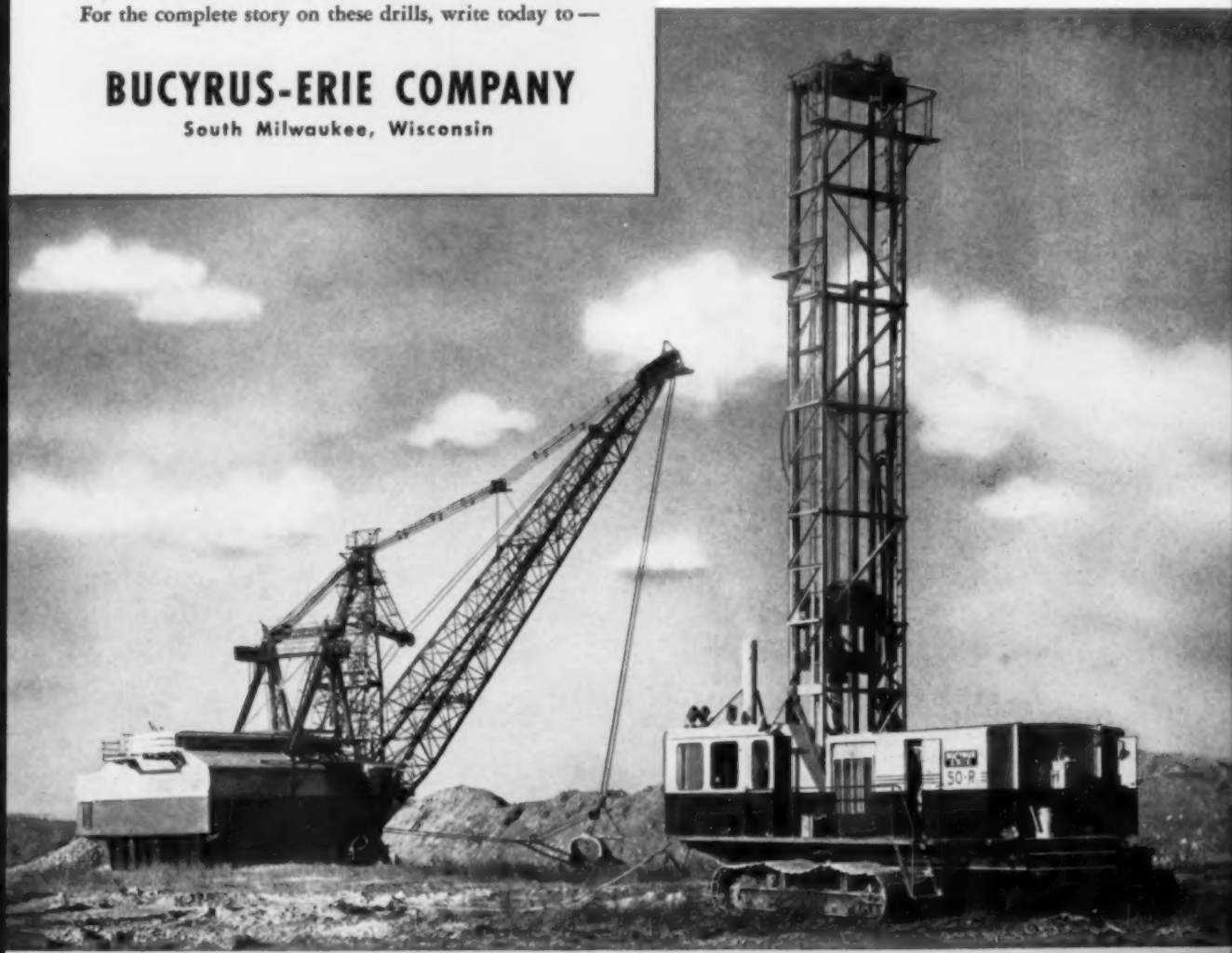
BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

All over the country the story is the same — those who buy one Bucyrus-Erie rotary soon want to convert completely to these moneymakers. Here are just a few of the many reasons why:

- Hydraulically-powered down pressure on the bit provides maximum controlled penetration.
- Ward Leonard electric control on rotation of the drill stem permits drilling at the most efficient speed for a given formation.
- Hole can be drilled continuously for the full length of a drill pipe. (32 ft. 9 in. for the 50-R; 27 ft. 9 in. for the 40-R)
- A remote-controlled, power-driven drill pipe rack adds or removes drill pipe without manual effort. Rack also stores pipe not in use.



36B56C



The strongest rack bar makes the toughest jack



A ratchet jack like the Duff-Norton all-purpose 516 MT is no stronger than its rack bar, the notched steel "heart" that moves up and down holding the load. The forged steel rack bar on this 5-ton capacity coal mining jack is stronger and tougher than the rack bar on any other ratchet jack of this type. It's *stronger* because it's *larger*!

Next time you see a Duff-Norton jack, examine the rack bar; you'll notice it's oblong like this . Then look at the rack bar on any other make ratchet jack. It's smaller, like this .

So get the most and best for your money with a Duff-Norton Jack.

Ask your distributor for information about Duff-Norton Jacks for coal mines. There's a jack for every lifting, pulling, and pushing job . . . or write the world's oldest and largest manufacturer of lifting jacks for your copy of "A Handy Guide for Selecting Duff-Norton Mine Jacks." Ask for bulletin Ad 10-J, Duff-Norton Company, P.O. Box 1889, Pittsburgh 30, Penna.

Long a favorite with coal miners is the 516 MT. It can raise 5 tons up to 9½ inches, is only 16 inches high when closed, has the famous oblong rack bar for greater strength and dependability.

DUFF-NORTON *Jacks*

"Giving Industry A Lift Since 1883"

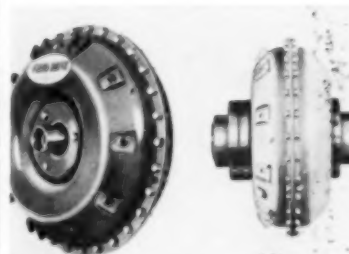
Equipment News (Continued)

placeable, self-sharpening wearpoints and are angled down to provide an 8-in penetration when the bottom of the bucket is parallel with the ground.



Tight-Quarters Operation

A 3/4-ton lever hoist using 1/3 arc movement for operation has been designed by the Tern Machine Co., Winona, Minn., for angular, horizontal and vertical lifting. The manufacturer recommends it for large or small shops. The 1/3 arc movement enables the hoist to be operated in tight or limited quarters, the maker says. A ratchet with two ratchet levers in constant contact with the ratchet wheel keeps the hoist wheel under control. In tests the hoist required 60% less effort to perform the same lifting job performed by a differential hoist.



Industrial Drive Unit

A traction type "Gyrol Fluid Drive" for general industrial application is available from the American Blower Corp., Detroit 32, Mich. Designated Size 126, Type T, the basic unit is designed for industrial use with internal combustion engines (left, photo). Power rating is 25 to 85 hp, depending on drive speed. When modified by installation of a flexible coupling half on each side of the fluid drive (right, photo), the new unit is said to be suited to constant speed electric motor applications for driving production and processing equipment, machine tools, conveyors and material handling installations. As a motor driven unit, the Size 126 is rated at 7½ to 15 hp with 1,200 rpm drive speed, 25 to 50 hp at 1,800 rpm.



This Headed Roof Bolt helps prevent roof falls

Roof falls, resulting in injury and loss of production, are less likely when you use roof bolting, with Bethlehem's square-head roof bolt. This method of roof support promotes safety because it anchors overlying rock. What's more, roof bolting offers these other worthwhile advantages: (1) improved ventilation, due to the absence of bulky supports, (2) increased production through greater freedom in operating mechanized equipment, and (3) less need for storage space, both above and below ground.

Used with Expansion Shell

The Bethlehem square-head roof bolt owes its positive locking action to the leaf-type malleable-iron shell with which it is used. When the bolt is tightened, the leaves of the shell expand, providing a firm four-way grip against the sides of the hole. A square roof plate provides additional support. A hardened washer, furnished with the assembly, reduces friction between the bolt head and roof-plate.

Bethlehem also manufactures a 1-in.-diam slotted roof bolt, used with a steel wedge. This bolt, because of its larger diameter, is ideal where maximum strength is required. It is also suitable for pillar bolting. When installed, the wedge is driven into the 6-in. forged slot, spreading the bolt-ends to fill the hole.

If you would like to consider a roof-bolting program, we suggest you would find it worthwhile to talk with a Bethlehem representative. Just get in touch with our nearest sales office.

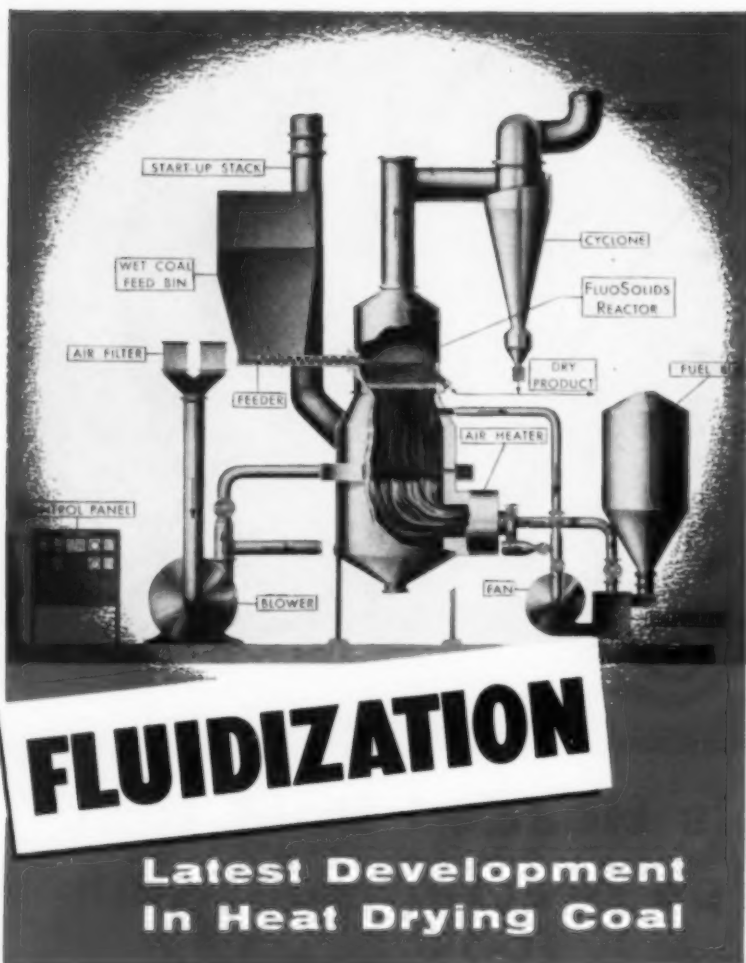
TYPE	DIAM	TYPICAL BREAK LOAD, LB
Carbon	$\frac{3}{4}$ in.	24,000
High-Strength	$\frac{5}{8}$ in.	24,000
High-Strength	$\frac{7}{8}$ in.	45,000

BETHLEHEM STEEL COMPANY BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL





Now available on a commercial scale, the Dorco FluoSolids System provides a new and improved method for drying fine coal using fluid techniques. For the preparation plant it offers these proven advantages:

HIGH CAPACITY per unit area . . . up to 200 tons per hour in a single Reactor.

CLOSE OPERATING CONTROL and uniform bed temperature with no oxidation of the finished product.

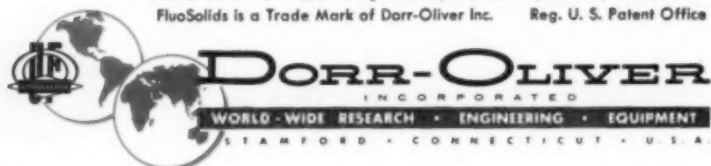
NO MOVING PARTS inside the Reactor exposed to high temperature or abrasive dust . . . scaling and maintenance reduced to a minimum.

HIGH DRYING EFFICIENCY with each particle surrounded by a film of hot gas . . . vaporization practically instantaneous.

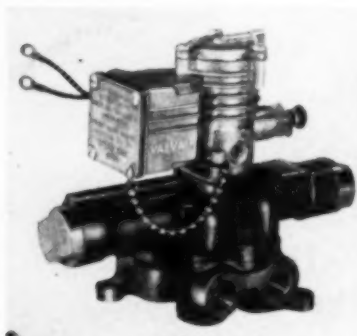
START UP AND SHUT DOWN TIMES easily meet preparation plant requirements.

For more information on this radical departure from conventional fine coal dryers, write for a copy of Bulletin No. 7503. Dorco-Oliver Incorporated, Stamford, Conn., U. S. A.

FluoSolids is a Trade Mark of Dorco-Oliver Inc. Reg. U. S. Patent Office



Equipment News (Continued)



Solenoid Control Valve

"Speed King," a new series of solenoid pilot-operated control valves being manufactured by the Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, are said to meet or exceed the JIC Pneumatic Standards. Features: moisture and dust-proof solenoid enclosure; a safety solenoid cover that renders the valve electrically inoperative when the cover is removed; an integral junction box large enough to accommodate 6-in taped pigtail leads. The company says the valves have a service life in excess of 25 million cycles and are capable of controlling more than 600 cycles a minute. Manufactured in 1/4-in, 1/2-in, 3/4-in and 1-in pipe sizes, the valves' pressure ranges in psi are: 35-200 air and 35-125 hydraulic oil for both single and double solenoid valves with internal pilot supply; 0-25 air, hydraulic oil and water for both single and double solenoid valves with external pilot supply; 50-125 for water for single and double solenoid valves with internal pilot supply.

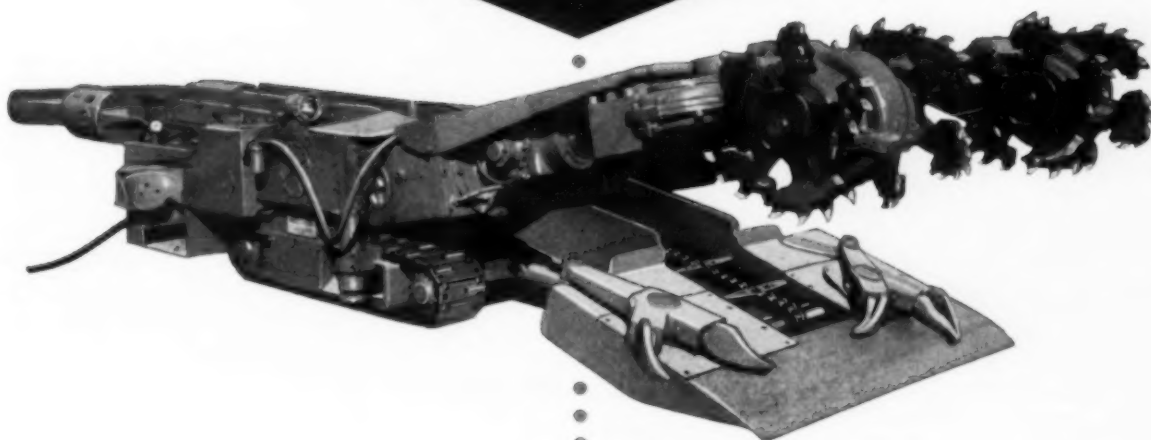


Corrosion Resistant Ducts

Haveg Industries, Inc., 900 Greenbank Rd., Wilmington, Del., has introduced a number of various ducts, hoods and fittings for corrosion resistant service. The units are manufactured entirely of polyester glass-reinforced plastic. They are light, tough and strong, the maker says, and adds that they offer chemical resistance to acid and corrosive conditions. Any size and shape duct hood or stack can be produced, Haveg says.

8 important REASONS why you should choose the

Lee-Norse MINER



1. The Lee-Norse Miner cuts and loads coal at a rate of 2 to 3 tons per minute.
2. The Lee-Norse Miner is the only machine that cuts continuously a "DIAMOND PATTERN" in the face of the coal. This new and unique method of cutting coal produces "Coarse Cuttings" and less fines.
3. The Lee-Norse Miner is built like a modern Coal Loading Machine with improved "DUAL" gathering arms and flexible conveyor and with the exclusive Lee-Norse Cutter Head, which cuts from the roof down to the floor and gathers all the coal as it is cut.
4. The Lee-Norse Miner operates with the same electric power, now provided for conventional mechanical mining—No need for larger power facilities.
5. The Lee-Norse Miner, built like a flexible, mobile loader, has excellent clean-up . . . no need for auxiliary loading machine.
6. The Lee-Norse Miner is designed for easy maintenance. All gear drives, electric motors and hydraulic pump and motors are located on the outside, where they can be attended to quickly. No swinging head or turntable—no chain drive—makes for less maintenance.
7. The Lee-Norse Miner has "Low Bit Cost" due to the solid mounting of cutter bits and unique method of cutting coal.
8. The Lee-Norse Miner is well proportioned in size and weight to suit present day mining conditions. With simple control and high tramping speed it operates and moves like a modern mobile loader and not like a semi-stationary miner.

Write today for literature:

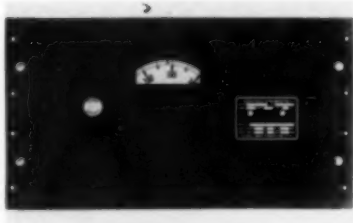
Lee-Norse Company

CHARLEROI, PA.

Specialists in Coal Mining Equipment

Transmits Pneumatic Signal

An electronic potentiometer measuring instrument equipped with a pneumatic transmitter that sends a 3-15 psi signal proportional to the measured variable has been announced by The Bristol Co., Waterbury 20, Conn. Named the Dynamaster Pneumatic Transmitter, the unit is available in either potentiometer or bridge circuits and will measure any variable that can be translated into an electrical quantity. It then converts the measurement into a universal 3-15 psi pneumatic signal for transmission to a remote pneu-



matic indicator or recorder. The company says it is possible to present measurements such as speed, viscosity, pH, resistance, smoke density, current and voltage, frequency and conductivity.



All-Purpose Shovel

Outstanding features of "The Yumbo," a hydraulic shovel developed in Italy, according to Geco Inc., 5701 Colorado Blvd., Denver, Colo., are a precision-built ball-bearing turntable and a heavy duty hydraulic system. The turntable consists of lower and upper races, integral gear and center race and 168 ball bearings. Geco, Inc., says "The Yumbo" is the only shovel that has a ball bearing turntable with two races of balls working in compression. This, says the company, reduces friction and permits smooth, fast action under load. The unit's heavy duty hydraulic system includes three double-acting cylinders, one hydraulic motor, four two-way control valves and a hydraulic pump. Requiring only 30 hp, the unit is equipped with an International U169 gasoline engine. An all-purpose tool, "The Yumbo" can be fitted with a 1/4-yd backhoe, a 3/8-yd front dump bucket, a 3/8-yd rock bucket, a 3/8-yd gravel bucket, a 1/2-yd clamshell and a 6,500-lb crane hook.



Leak-Proof Valve

A newly developed plastic seal has enabled the U. S. Valve Corp., 831 Bond St., Elizabeth 4, N.J., to introduce a reportedly leak-proof valve. The company says the valve is ideally suited where leak-proof valves are a vital necessity. U. S. Valve also says that the unit remains completely leak-proof under pressure of 725 lb psi and permits no drop in line pressure. Its working pressure is quoted at 435 lb, its temperature limitations at 250 deg. The plastic seal has a shore hardness

More than ever

TOPS

IN THE
COAL MINES!



Today most mines buying roof control drills are buying FLETCHERS!

The many exclusive features found on the entire FLETCHER line mean more bolts per man at lower cost to you! And here they are:

- Jack-feed system delivers maximum smooth thrust with quick raise and return.
- Hydraulic lowering device lets you drill directly from the mine floor.
- Hydro-slide moves your drill across the place smoothly, accurately and fast.
- Compact frame and third-wheel steer makes tramming quick and easy.
- Height range from 28 inches to 14 feet lets you select a drill to exactly fit your mine.
- Telescoping mast gives full stroke in varying seam conditions. And the new floor-to-roof mast gives added safety, speed and power.



Find out NOW how you can have these features for YOUR mine. Write now for complete information.

J. H. FLETCHER & CO.

P. O. Box 353, HUNTINGTON 8, WEST VIRGINIA
Phone 44186

"We do '4-hr. jobs' in 2 hrs. with our new TD-9 Skid-Shovel"

—Beatrice Concrete Co.
Beatrice, Nebraska



"Snappiest loader on the market"

Hoosier Lime and Stone Co., Salem, Indiana, added a bonus-powered International Drott TD-9 Skid-Shovel to load crushed stone, level overburden, do custom excavating. "This is the snappiest tractor shovel on today's market," states Operator Lawrence Rutherford. "The new TD-9 Skid-Shovel lifts faster, has more engine power, plenty of operator room and comfort, operates easier, has much better vision."



"Plenty of power . . . perfect vision"

This new TD-9 Skid-Shovel loads 12 to 15 tons of zinc ore from stockpile, every 3 or 4 minutes. Turley and Yates, Rutledge, Tenn., also dig basements, clear and drain land, do custom loading with it. Says Partner Joe E. Yates: "It's fast, easy to operate, has plenty of power, and perfect loading-cycle vision. Hydro-Spring is a life-saver to unit and operator. Roomy seat and handy controls increase output, reduce tiring."

"First thing we noticed about this new International Drott was that it does former '4-hour jobs' in 2 hours," reports Supt. Eldon Chamberlain. "Watching it showed why it doubles production. This new rig fills a bucket easier and faster with pry-action break-out. Operator has better control, watches bucket action more easily—and added hp does top speed work with no strain on machine or operator."

This ready-mix concrete company also excavates and grades—digs basements, backfills, and loads spoil dirt. They recently replaced their older crawler-loader with a new International Drott TD-9 Skid-Shovel.

See how exclusive pry-over-shoe break-out action—now increased to 10,000 lbs. in the International Drott TD-9 Skid-Shovel—gets you the "too-tough-for-others" jobs; helps out-produce 'em anywhere. Prove exclusive, shock-swallowing Hydro-Spring as a cost-cutting yardage-booster. Or, try an exclusive Four-In-One Skid-Shovel—4-machine utility, one moderate investment. Ask for a demonstration!

See you at the ROAD SHOW
CHICAGO
Jan. 28-Feb. 2, 1957

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 8, Wis.



INTERNATIONAL® DROTT®

Equipment News (Continued)

of 80. No maintenance or lubrication is required after installation.

Neoprene In Liquid Form

The Wilbur & Williams Co., 130 Lincoln St., Boston 35, Mass., has announced a rubber-coat liquid neoprene available for brushing or spraying. Usual shelf life limitations have been eliminated, according to the company, which says that it is not necessary to make a monthly check of shelf life since the liquid is replaceable by the manufacturer if the material should become unusable.

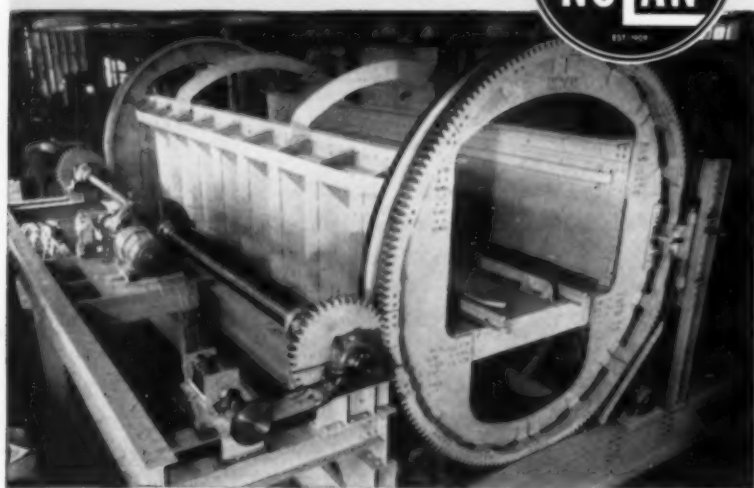


Check Valve Built In

Kenco Pump Div., American Crucible

Products Co., 1305 Oberlin Ave., Lorain, Ohio, is producing a 3,000 gph submersible multi-purpose pump. Identified as Model 140, the pump's features include a built-in check valve, air lock eliminator, Kenco-GE Switchette control and Thermo-plastic cord and cap. The unit is designed for both completely automatic intermittent operation and for continuous submerged duty. The built-in check valve, according to Kenco, will prevent water from running back.

THE NEWEST in Rotary Car Dumpers



Safe, High Speed Dumping thru Full 360° Arc Fully Automatic with Selective Manual Control

NOLAN AGENTS:

George C. Hutchinson, Jr.
1304 Keenan Building
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& Equipment Company
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John Lloyd & Sons
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Wilkes-Barre, Pennsylvania
E. C. Horne Machinery Company
1726 Champa Street
Denver 2, Colorado
Frank C. Memmott
P.O. Box 154
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Amos A. Culp
429 South 24th Street
Birmingham 5, Alabama
John North Associates
P.O. Box 105
Marbert, Michigan
(Chicago District)

This is the latest in car dumper engineering, and includes advancements made as the result of nearly 50 years experience in mine-car dumping and control equipment.

FEATURES:

- Designed for Today's High Capacity Mine Car
- Gear Driven through Flame-Hardened Gears
- Complete with base frame, dump sheets, and liner plates
- Anti-friction Bearings throughout
- Wide Faced Dump Rings of Special Alloy Steel
- Equipped with Nolan Patented Cushioned Rail Aligning Stop

Write for details on this new NOLAN Car Dumper, and ask us to help solve your car control problems.

THE NOLAN COMPANY

Bowerston, Ohio



10,000-Lb Capacity Crane

A mobile crane, the Hyster model "Kerry Crane," has been introduced by the Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore. The unit has a 10,000-lb capacity and is designed to move any shape load that can be placed under its boom. Power steering is standard equipment. Trunnion type steering wheels, a short turning radius and a rounded rear end are designed to permit maneuverability.



Pressure Regulators

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N.Y., is producing a line of low priced, inverse-type oxygen and acetylene pressure regulators. Designated the Airco Series 8,000 Regulators, the units are designed to meet the needs of small metal fabrication shops. A two gage type measures 4½x4½-in, weighs 2 lb, 4 oz; a single gage regulator measures

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

Approved by the Institute of Makers of Explosives, September 30, 1955

READ
DO'S & DON'TS
CAREFULLY

THE prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING: All explosives are dangerous and must be handled and used with care either by or under the direction of competent experienced persons. It is the responsibility of all persons who handle explosives to know and to follow all approved safety procedures.

It is obviously impossible to include warnings or approved methods for every conceivable situation. A list of suggestions to aid in avoiding the more common causes of accidents is set forth herein. Additional information is available in the Institute of Makers of Explosives Publications listed: "Standard Storage Magazines" (Pamphlet #1); "American Table of Distances" (Pamphlet #2); "Safety First" (Pamphlet #3); "Safety in the Handling and Use of Explosives" (Pamphlet #17); "Radio Frequency Energy—A Potential Hazard in the Use and Transportation of Electric Blasting Caps" (Pamphlet #20); "Explosives in Agriculture" and "How to Destroy Explosives." When in doubt, consult the manufacturer.

DEFINITIONS

1. The term "explosives" as used herein includes any or all of the following: Dynamite, black blasting powder, pellet powder, blasting caps, electric blasting caps, and detonating fuse.
2. The term "electric blasting cap" as used herein includes both instantaneous electric blasting caps and all types of delay electric blasting caps.
3. The term "primer" means a cartridge of explosives in combination with a blasting cap or fuse.



Send for your
FREE COPY of

do's and don'ts with explosives!

Everyone who has anything to do with explosives should have a copy of this new, revised, up-to-date list of *instructions and warnings*, approved by the Institute of Explosives Makers.

It covers important functions in the handling and use of explosives—*lists 72 Do's and Don'ts* for prevention of accidents in handling, transporting, storing, loading, tamping, shooting and disposal.

Contains vital precautions when shooting either electrically or with cap and fuse . . . eleven suggestions for minimizing poison gas hazards . . . prevention of misfires . . . approved methods for priming. Send for your *free copy today!*



EXPLOSIVES
DIVISION

ATLAS

POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

Explosives Division
ATLAS POWDER COMPANY
Wilmington 99, Delaware

Please send me a copy of the new "DO'S and DON'TS with Explosives."

Name

Company

Address

City State

Equipment News (Continued)

3½x5½-in, weighs 2 lb, 1 oz. Other features: molded rubber diaphragm with fabric insert; relief valves on oxygen regulators; reversible nylon seat; and no pressure seals.

Automatic Rule Reading

An extension tape rule that permits immediate readings from a built-in dial is being manufactured by the Frederick Post Co., 3650 N. Avondale Ave., Chicago, Ill. Named the Rulo-Matic, the rule



shows measurements to a fraction of an inch. The dial shows 1/16-in fractions.

There's **NOTHING ...**
like

**CUSTOMER
SATISFACTION!**

Smart mining men have found that
no other equipment matches the
efficient, trouble-free performance
of **STAMLER** equipment.

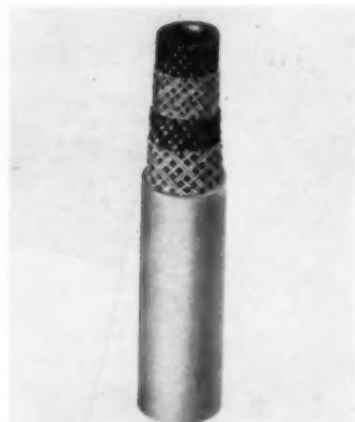
STAMLER equipment increases tonnage. **STAMLER** equipment reduces costs! **STAMLER** equipment operates at the lowest possible maintenance figure. The result of these three features is complete customer satisfaction which **STAMLER** users express by their repeat orders. The **STAMLER** Hydraulic CAR SPOTTER has been in use twice as long as any other! The **STAMLER** Hydraulic AUTOMATIC LOADING STATION is the only successfully manufactured time-proven production item of its type! Used in combination, this equipment will load your cars automatically, uniformly and without spillage! No lost time . . . no needless labor at the loading point! You get

the coal out faster, more efficiently and at less cost! That's why the big preference is for **STAMLER** equipment. That's why you should be thinking about how you can apply **STAMLER** superiority to your operation."

STAMLER
LOADING POINT
EQUIPMENT

W. R. STAMLER CORP.
PARIS, KENTUCKY

SCHROEDER BROS., Exclusive Eastern Sales Agent
PITTSBURGH, PENNSYLVANIA
UNION INDUSTRIAL CORP., Carlsbad, New Mexico
SALMON & CO., BIRMINGHAM, ALABAMA



Light, Low Cost Hose

"Duraprene," a lightweight low-priced air hose designed as a general utility unit is being manufactured by the Acme Rubber Mfg. Co., Lever St., Trenton, N.J. Its cover and tube are oil resistant, according to the manufacturer, and it is reinforced with two plies of high tensile braided rayon cord. The hose is made with inside diameters of ¼-, ½-, ¾- and 1-in for 200 lb working pressure; ½-, ¾- and 1-in for 150 lb working pressure.

Equipment Shorts

FLOORING COMPOUND—Quick - setting, flooring compound, Stonhard "Stonfil," which hardens within 30 to 40 min. has been developed by the Stonhard Co., Inc., 1306 Spring Garden St., Philadelphia 23, Pa. Small ruts, holes or cracks in concrete floors can be filled with a minimum of delay, the company says. Used in freezing temperatures "Stonfil" hardens in an hour.

ROOF-COATING—A roof coating containing aluminum blended with a "refined vehicle" and a special grade asbestos fiber is being marketed by the Stonhard Co., 1306 Spring Garden St., Philadelphia 23, Pa. Stonhard says the aluminum will not rise to the surface and flake off.

Free Bulletins

BATTERIES—Exide's "Tytex" batteries, designed for stationary power applications, are the subject of a catalog (form 5907) being distributed by the company. Improvements reportedly extending service life up to 10% are described. Box 8109, Philadelphia 1, Pa.

ENGINEERING, DESIGN, CONSTRUCTION—The W. K. E. Div., Western Machinery Co., 760 Folsom St., San Francisco 7, Calif., describes in 28 pp its operations and experience in engineering, design and construction of mines, process plants and industrial facilities. Form 63-B33.



EXTRA DUTY FROM WIRE ROPE

Extra duty — extra hours! That's what users report for Yellow Strand Flattened Strand on mining operations.

Yellow Strand Flattened Strand has strands of triangular shape — distributing the wear over a greater number of wires. This means longer life and less wear on rope and grooves. In addition, it's manufactured to the highest standards of quality by Broderick & Bascom Rope Co.

Take the tip from many satisfied users of Yellow Strand Flattened Strand and specify it on your next

order. Take advantage, too, of the prompt service and "on hand stocks" of nearby Yellow Strand Distributors. They're ready to serve you with the right rope when you need it.

COMPARE

Yellow Strand Flattened Strand with Round Strand Wire Rope. In Flattened Strand you have twelve contact points, greater bearing area, smoother surface, less wear. Result: longer service, lower final cost!



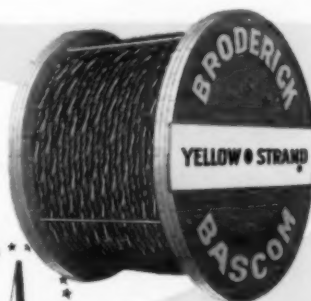
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Strand
Wire Rope



Round
Strand
Wire Rope

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For More Efficient Cleaning of High Refuse Feeds



"Patented"

Cleaning fine coals containing a high percentage of refuse is no problem when you employ the SuperDuty® DIAGONAL-DECK® Model HCRD Coal Washing Table.

The refuse discharge capacity of this table has been greatly increased to prevent crowding of material bed on the table. This speeds up the separations, and results in cleaning efficiencies equivalent to those obtained on normal feed coal washing operations.

Patented SuperDuty HCRD tables thus increase profits two ways, first by assuring greater daily production due to faster disposition of refuse, and secondly by leaving less coal in the refuse than possible with any other fine coal washing process. For detailed information write for Bulletin 119.



CONCENCO® FEED DISTRIBUTOR

While unexcelled for feeding coal washing tables, the CONCENCO Revolving Feed Distributor effectively provides a splitting of feed into any desired number of equal portions, to accurately feed circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all steel machine with motor drive requiring 1 H.P. or less in operation.

THE DEISTER ★ CONCENTRATOR COMPANY

903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

CONCENCO
PRODUCTS

★ The ORIGINAL Deister Company ★ Inc. 1906

Bulletins (Continued)

LUBRICATION—Fiske Bros. Refining Co., Lubriplate Div., 129 Lockwood St., Newark 5, N. J. is distributing "Lubriplate Data Book 56-1," a booklet that describes proper lubrication as the "life blood of all machinery."

WIRE ROPE—Directions for the handling and care of wire rope are included in an 85-p catalog being distributed by American Steel & Wire, Div. of United States Steel, Rockefeller Bldg., Cleveland 13, Ohio. American's "Tiger Brand" wire rope is featured.

GROUTING—Specifications for the non-shrink grouting of heavy equipment, anchor bolts, building columns and bridge seats are being distributed by the Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio. The specifications, in eight sections, include grouting materials, storage, mixes in relation to clearance, mixing the grout, forming, preparation, placing the grout and finishing.

SYNCHRONOUS MOTORS—Allis-Chalmers describes construction features of its large end-shield bearing synchronous motors in Bulletin 05B8305. A-C Mfg. Co., 968 S 70th St., Milwaukee, Wis.

FEED CONTROL—Hardinge Co., Inc., York, Pa., is distributing Bulletin 42-A in which the company's "Electric Ear," a device that automatically regulates the flow of feed material is featured.

TAILOR-MADE SPLICES—A booklet containing application information on "Scotchcast" splicing kit 90-B1 is being distributed by the manufacturer, Minnesota Mining & Mfg. Co., Dept. D6-157, 900 Fauquier St., St. Paul, Minn. Electrical and physical properties of epoxy resin used in the kit are listed.

HYDRAULIC OIL COOLERS—Vickers, Inc., Box 302, Detroit 32, Mich., is distributing Bulletin 55-69 featuring the company's air type and water type hydraulic oil coolers for hydraulic systems.

REPLACEMENT SCREENS—Bulletin 67, published by Simplicity Engineering Co., Durand, Mich., contains information on woven wire screen for repair and replacement.

MINE EQUIPMENT, SERVICES—Western Machinery Co., 760 Folsom St., San Francisco 7, Calif., is distributing a catalog that lists the company's equipment and services for mines and process plants. Lab services, engineering, design and construction facilities are featured.

HOSE AND FITTINGS—Aeroquip Corp., Jackson, Mich., is distributing a catalog listing hose, fittings, socketless kits and self-sealing couplings designed primarily for replacement. No. 174.

CHEMICAL RECOVERY FILM—A 23-min sound film, "The Waiting Harvest,"



How a new **CAT*** No. 12 can **STEP UP YOUR MINE'S EFFICIENCY 3 WAYS**

This new Caterpillar No. 12 Motor Grader maintains 16 miles of haul road and 'dozes truck spillage at the Hill-Trumbull Mine, Marble, Minn. It is owned by the Mesaba-Cliffs Iron Company and operated by the Cleveland-Cliffs Mining Company of Cleveland, Ohio. In building and maintaining haul roads for faster cycle times and reduced wear and tear on equipment, in 'dozing and clean-up work, the new Caterpillar No. 12 does a big and important job. Here is how it can do it at lower cost in *your* mine:

1. LOWER OPERATING COST. The new No. 12 delivers its 115 HP on non-premium, low-cost fuels. Its new oil clutch gives you longer clutch life, easier operation, and as much as 1500 hours between clutch adjustments. Tubeless tires (furnished at no extra cost) run cooler, last longer, and eliminate the tube and flap down time of old-fashioned tires.

2. LONGER WORK LIFE. Like all Caterpillar Motor Graders, the No. 12 is built—not just assembled—by a single manufacturer. This means traditionally sound Caterpillar ruggedness and workmanship, and careful balancing of engine and blade capacity for long life

and high efficiency. And it means a single source for parts and service—your reliable Caterpillar Dealer.

3. INCREASED PRODUCTION. Positive, non-creep controls, easy "feel-of-the-road" steering, sure-footed traction with engine positioned over the driving wheels, quick-change blade positioning, unobstructed visibility—all these are good reasons why operators *like* the Caterpillar No. 12 Motor Grader, and do more efficient work on any job.

Your Caterpillar Dealer will demonstrate these and other features of the fast-working, long-lasting No. 12 Motor Grader. See him for proof that the Cat No. 12 will do more work at less cost on *your* job than any other grader.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**99% OF ALL CAT MOTOR
GRADERS EVER BUILT
ARE STILL AT WORK**



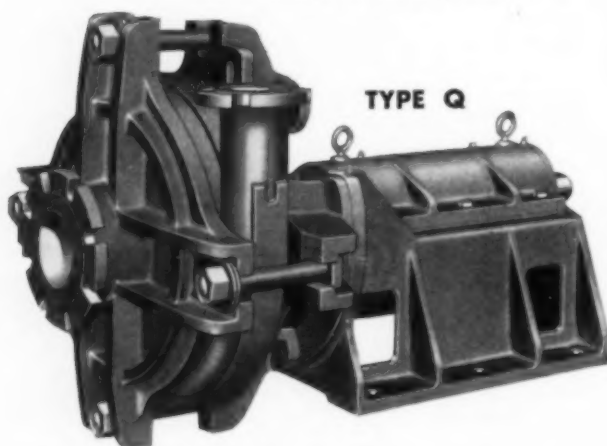
**misfits
cost
money...**

Coddling old pumps, "bargain" pumps or pumps that weren't engineered for the job can be an expensive proposition.

When misfits like this are put to work, they generally can handle only half the job they should. Often their "downtime" is greater than their operating time. And when pumps fail the greatest cost is not for repairs—but for lost production.

Start today by replacing "misfits" with new Morris pumps. For nearly a century Morris has been manufacturing a complete line of top quality pumps to meet the diversified requirements of industry. Every Morris pump has been specially designed and engineered to handle a specific job and to give you years of trouble-free service under the most rugged conditions.

Specify Morris when you want lasting pump value . . . it will save you money in the long run.



TYPE Q

MORRIS
CENTRIFUGAL
PUMPS

● **Free Service.** Morris Engineers will be glad to recommend the pump best suited to your needs for size, capacity, etc. Send necessary data today to Morris Machine Works, Baldwinville, N. Y.

Bulletins (Continued)

which illustrates the recovery of basic chemicals from once wasted materials in the coke making process, is being distributed by United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. The film shows how modern products—plastics, perfumes, paints, drugs, fertilizers, insecticides—are being produced from the recovered chemicals.

MINING TOOLS—A revised "Carmet Mining Tool Catalog and Methods Manual," in which redesigned Carmet tools are included, is being distributed by Allegheny Ludlum Steel Corp., Advertising Dept., 2020 Oliver Bldg., Pittsburgh 22, Pa. Technical data on tool design, size and shape of mining bits, roof drills and coal drills are given.

GEARMOTOR—Booklet B-6579, distributed by Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa., presents the Type R right-angle gearmotor for applications requiring 1 to 30 hp.

INDUSTRIAL DIAMONDS—Pictures, tables and text are used by the Diamond Tool Research Co., Inc., 380 Second Ave., New York 10, N. Y., to tell about diamond dressing and trueing tools, cutting and boring tools, powder, compound and plated mandrels. Catalog 5 includes descriptions of the qualities of diamond tool stones and blueprints of tools.

CENTRIFUGAL PUMPS—Form 7223-B, a bulletin being distributed by Ingersoll-Rand, 11 Broadway, New York 4, N. Y., covers the complete line of class CRV cradle-mounted centrifugal pumps being manufactured by the company. The pumps described have capacities from 5 to 2,800 gpm and pressures of 10 to 525 ft total head.

CONTROL VALVES—Three- and four-way directional control valves manufactured by The Oilgear Co., 1560 West Pierce St., Milwaukee 4, Wis., for fluid power systems up to 3,000 psi, are described in a 16-p bulletin (80300). Included are details of valve body construction and the functions of standard and special plungers.

PROCESSING EQUIPMENT—The "open door" design, through which access to vital parts of any Sturtevant processing unit is possible by "one man in one minute," is featured in a new catalog by Sturtevant Mill Co., 150 Clayton St., Boston 22, Mass. Named "Sturtevant Dry Processing Equipment," the catalog contains information on blenders, mixers, crushing and milling machines, air separators, pulverizers and screens.

TOWBOAT—A 4-p folder published by Dravo Corp., Neville Island, Pittsburgh 25, Pa., illustrates the Dravo RAM-class 70-ft diesel powered towboat. Power and maneuverability are among the features described.

There's more in this barrel for you...



James E. Pratt, left, Socony Mobil engineer, obtains performance data on hydraulic system at an aluminum extrusion plant.

MORE ENGINEERS

to help you improve production and cut costs!

Specify Socony Mobil and get the services of more industrial lubrication engineers than are provided by any other oil company.

These specialists, working closely with your Mobil representative, will help you set up a plant-wide program of correct lubrication . . . advise on any lubrication problems that might arise. Their long experience and expert recommendations can improve your production and cut costs.

Socony Mobil products are also backed by *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY
SOCONY MOBIL



FIRST STEP
IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
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LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

NEWS ROUND-UP



Start Utah-Colorado Solid Mineral Pipeline

Construction of one of the world's longest pipelines to carry a solid hydrocarbon material is now underway between Bonanza, Utah and Gilsonite, Colo., near Grand Junction, Ernest F. Goodner, president, American Gilsonite Co., Salt Lake City, Utah, announced in New York July 11.

The 70-mile pipeline, which will traverse some of the most rugged, uninhabited Rocky Mt. terrain, is part of a \$16-million project for converting "gilsonite" or uintaite ores into high-purity coke, gasoline and fuel oil. The coke is expected to find a ready market in aluminum manufacture and specialty carbon fields. The petroleum products will be sold in nearby area markets. (Up to now, gilsonite has been used largely in making asphalt tile, storage battery boxes, inks,

paints, varnishes, and as insulation for hot underground pipes.)

Besides the pipeline, estimated to cost \$2 million, other parts of the project now underway include:

1. Introduction of "wet" hydraulic mining techniques at the Gilsonite Co.'s Bonanza mines to eliminate explosion

hazards from gilsonite dust in confined areas.

2. Construction of a processing plant, scheduled for completion in the spring of 1957 at Gilsonite, Colo., for converting gilsonite ore into high-purity coke, gasoline and fuel oil.

Mr. Goodner referred to the pipeline as "perhaps the most unusual aspect of the new coking plant operation." He said that the line will be 6-in pipe, buried beneath the frostline, and will carry a slurry of gilsonite and water. The concentration of the gilsonite slurry will range from 20% to 60%. To prevent the solid material from settling out, the slurry will be kept moving through the line at relatively high velocities, from 200 to 500 gpm. The grade on the line will be kept to a flat slope to eliminate plugging. And the line is designed so that it will be very difficult to shut it down accidentally. To minimize pipe corrosion, free oxygen will be removed from the slurry with sodium sulfite.

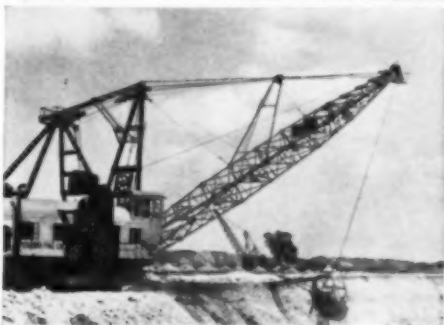
Three pumps, each with 570 hp, will be maintained at the Bonanza pump station. Two pumps will be operating and one will be a standby ready to go at a moment's notice. All will be electric motor driven. In the event of a power failure, the diesel pump that supplies the jet mining water will be used to push water into the pipeline. In addition, there will be a water reservoir at the top of Baxter Pass for flushing the line should the flow stop for some unforeseen reason. The pumping units will maintain a pressure of 2,200 lb psi. The pipeline will hold 1,000,000 gallons of water.

Gilsonite ore will flow into the processing plant at the rate of 630 tpd. The plant's output will be 250 tpd of coke; 1,300 bbl per day of gasoline and 300 bbl per day of fuel oil. Initial plans for the project were announced last year by the American Gilsonite Co. after several years of research and pilot plant development. The American Gilsonite Co. is a joint affiliate of Barber Oil Corp. and Standard Oil Co. of California.

Pipe work on Pitt Consol's 108-mi coal-carrying pipeline in Ohio has been completed. The line originates two miles south of Cadiz, Ohio, terminates at East Lake, near Cleveland, the site of a Cleveland Electric Illuminating Co. power station. The line has been constructed with 10-in (inside) diameter steel pipe and has been laid 4 ft beneath the ground. Some 15,000 tons of steel were required during construction. Coal will be crushed and mixed with an equal weight of water, then forced through the line by three pumps stationed at 35-mi intervals. At a rate of 3 $\frac{1}{2}$ mph the coal will reach its destination in about 30 hr. Roughly, 3,600 tpd from mines operated by Hanna Coal Co. will be deposited at the East Lake terminus.

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Macwhyte Internal Lubrication gives you rope prepared especially for your service conditions—designed to resist abrasion, internal friction, and corrosion



Macwhyte PREforming gives MONARCH WHYTE STRAND the flexibility for improved handling and long service. There's a type and size for all drag line equipment.

Here's special rope ...made for mining!

Monarch Whyte Strand wire rope is available in the correct type and size you need for your equipment. This rope is made by Macwhyte to give you long, heavy-duty service on draglines, strip shovels, mine hoists, slope hoists, mining machines, loaders, and other mining equipment.

Monarch Whyte Strand is supplied properly PREformed for flexibility, and properly lubricated, depending upon the use of the rope, to resist abrasion, corrosion, and give maximum service.

Give Monarch Whyte Strand a chance to serve you. You will be more than pleased with its performance. Your Macwhyte distributor is stocked for immediate delivery.

Monarch Whyte Strand Bulletin 5425 is available from your distributor or write direct to Macwhyte Company.

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Manufacturers of: Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel Wire Rope, and Wire Rope Assemblies. Special catalogs available.

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Distributors conveniently located throughout United States



MONARCH WHYTE STRAND is made by Macwhyte in every wire rope classification to provide the correct size and construction for all strip mining machines.

1007H

ACS, Inc., Seeks Libertys For Overseas Coal Trade

In its first move as an organized, incorporated group American Coal Shipping, Inc., the new \$50 million shipping company backed by producing and exporting companies, rails and the UMWA (*Coal Age*, July 1956, p 122), last month asked the Maritime Administration for 30 Liberty ships on a charter basis from the reserve fleet. If Maritime approves the application the ships will be put into service as soon as possible, hauling an estimated 3 million tons a year.

(One spur to their immediate use is a rail application, filed with the ICC, that would result in increasing demurrage rates on cars to \$4 for the first two chargeable days; \$7 for each of the next two chargeable days and \$10 for each day following. In June *Coal Age* reported that a spot check at Hampton Roads late in April showed that there were about 18,000 cars waiting to be unloaded—considerably in excess of cargo space needed for expeditious handling, p 57)

Operating costs for the Liberty ships will be high. The charter price alone will be about \$7,000 a month each. Wages will run about \$860 a day. In addition, many overseas buyers will pay transportation costs in currencies softer than the American dollar, thus leaving ACS with the job of converting foreign currencies.

On freight rates, ACS says that the rates it hopes to apply will have to be worked out in actual operations. The ships will be operated at a profit and without subsidy. Still, ACS is sure it can undercut the \$11 per ton charge now levied on ocean-going coal.

Meanwhile, an assist in battering down ocean freight charges may be developing for the new company. A German firm, with the aid of Sen. James Duff (R-Pa.) is attempting to buy 24 coal-burning Libertys to haul coal bought in the United States to West Germany and other NATO countries. The company, the American-German Coal Transport Co., would carry about 2 million tons a year at an estimated price of \$7 a ton. Liberty ships, based on the \$500,000 price set by law would cost the German company about \$12 million. On the open market similar ships cost about \$1 million each.

Sen. Duff, on July 9, introduced legislation in Congress which would empower Secretary of Commerce Sinclair Weeks to sell the ships. But the belief in Washington is that Sen. Duff's bill was introduced too late this year for action. The bill is also sure of running into heavy opposition from U. S. ship operators and the maritime unions, neither of which cares for the idea of permitting foreign ship operators to pick up U. S. ships at bargain prices for competition against American flag vessels.

But, a glance at export tonnage and ship arrival statistics indicates that foreign ships have already made big gains.

On July 5, the Hampton Roads Maritime Association reported that despite



OATH OF OFFICE is taken by Marling J. Ankeny (right), 10th director of the U. S. Bureau of Mines. Floyd E. Dotson (left), chief clerk of the department, administered the oath during July 20 ceremonies in the office of Fred A. Seaton (center), Secretary of the Interior. As director, Mr. Ankeny returns to the agency he served for 24 yr. He resigned in 1952 to become safety director of the Bituminous Coal Operators Association.

a boom in coal exports, American ships are carrying less coal to foreign nations than they were a year ago. Thus far, the Association reports, only 27 American ships have loaded coal for overseas buyers. A year ago, when only half as much coal was dumped over local piers, 40 American ships were tied up to receive export cargoes.

Yct exports (bituminous) in the first six

months of 1956 totaled 21,531,261 net tons, an increase of 8,098,784, or 37.6%, over last year's 13,432,477 tons for the same period. Hampton Roads, alone, handled 19,063,948 net tons up to June, 1956, compared with 11,898,025 in the same period last year.

A New York shipping man of long experience, William Conant Brewer, was elected president of American Coal Shipping, Inc., June 28 in Washington, D.C., home office of ACS, Inc. Mr. Brewer, a shipping broker, was at one time director of stockpile and shipping for the War Production Board. He has also been associated with the Bull Steamship Line. In recent years he has maintained ship brokerage offices in New York.

Bituminous Output

YEAR TO DATE	PRODUCTION
July 14, 1956	264,214,000
July 16, 1955	235,905,000
1956 output 12.0% ahead of 1955.	
A month earlier output was 15.3% above 1955.	

WEEK ENDING	PRODUCTION
July 14, 1956	7,150,000
July 16, 1955	9,677,000

Anthracite Output

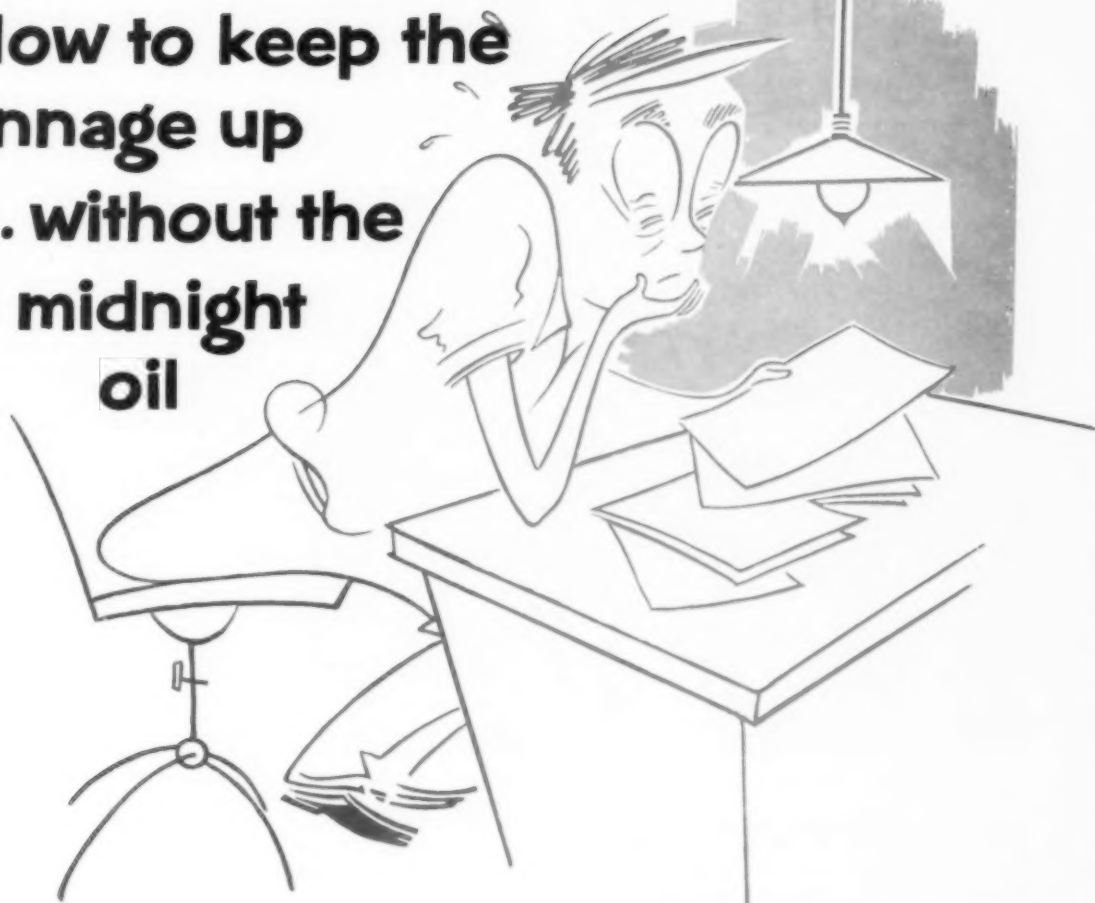
YEAR TO DATE	PRODUCTION
July 14, 1956	14,168,000
July 16, 1955	13,819,000
1956 output 2.5% ahead of 1955.	
A month earlier 1956 output was 1.4% ahead of 1955.	

WEEK ENDING	PRODUCTION
July 14, 1956	441,000
July 16, 1955	489,000

Acid Inhibitor Process Receives Second Setback

A promising mine acid inhibitor process developed by Johns Hopkins researchers 4 yr ago once again dropped back under the legal cloud that has shrouded most of its turbulent career. That career was launched in January 1953 when Walter A. Patrick, a physical chemistry professor, and Floyd W. McCollum, a chemical engineering student, announced that a chemical inhibitor might prevent natural formation of acid in active and abandoned coal mines. Their application for a patent on this finding immediately ran into a legal snarl. The U. S. Public Health Service held that any discovery made with support of public funds must be dedicated

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to public use. A USPHS grant to the Potomac River Basic Commission had financed Mr. McCollum's tests of the mine acid inhibitor theory.

It took more than two years to reach a settlement and clear a path for the Patrick-McCollum patent application. It was widely and happily assumed that since the legal storm had subsided, a patent would be granted without much trouble. But, the patent office rejected the application for lack of sufficient scientific evidence to judge the merit of the process. This outcome of the protracted squabble over patent rights has left the future of the mine acid inhibitor up in the air. But,

all three parties involved are considering steps to lift the uncertainty. Mr. McCollum has turned over to the Potomac River Commission the data on field tests he conducted on the process—data insufficient to satisfy the patent office. The Commission, in turn, has relinquished its claim of future patent rights to U. S. Public Health Service and has forwarded all data on the process to USPHS. The next step is up to USPHS. So far, it's undecided on how to proceed, but is weighing this plan: transmit the process details and all test data to its Taft Engineering Research Center at Cincinnati for expert appraisal and guidance on whether USPHS should

put up the money for further field tests.

Pending the experts' report, Washington's view is that the Patrick-McCollum process is a promising lead—the only one to turn up so far—to licking mine acid wastes—still the leading unsolved water pollution problem. But even if Cincinnati confirms this view, USPHS still must find the money for a field test program. Right now, the money picture is clouded. USPHS—with the President's signature hardly dry on the new and broader Federal Water Pollution Control Act—is racing against time to get an appropriation for fiscal 1957 through Congress before adjournment. USPHS wants \$2 to \$3 million for water pollution research this year and had not planned when drawing up this request on including tests of the mine-acid inhibitor. So, if USPHS fails to get all the research money it wants, financing the test program will be doubly hard.

Future patent moves are likely to be guided by USPHS decision on whether or not to run extensive tests on the process. If the test program does come off—and the results are favorable—USPHS probably will apply for a patent in its own name. In the event USPHS drops the idea of further testing—for lack of funds or an adverse report from its Cincinnati engineers—it probably will publish all process details and the McCollum field research report, for others to carry on from there.

What rights Mr. Patrick and Mr. McCollum retain in the process is still uncertain. The Commission says they have relinquished future patent rights to the commission only for use of the process for mine wastes, but still have the rights to apply for patents on all other potential uses (e.g. as a rust inhibitor). But, USPHS says the Commission relinquished to USPHS its right to patent the process and the patent office has ruled that the process as of now is unpatentable.



EVOLUTION OF THE MINE LAMP is traced by Paul S. Carter (center), maintenance superintendent, Armco Steel Corp. Mines, Montcoal, W. Va., during a meeting of the Appalachian Chapter of the West Virginia Society of Professional Engineers, Beckley, W. Va. Lamps are the oil burning cap lamp (left), carbide lamps, flame safety lamps, the modern battery-cap lamp and, still in the experimental stage, the modified household fluorescent lamp. Looking on are Tom Howard (left), mining engineer, New River Co., Mt. Hope, W. Va.; Lloyd G. Fitzgerald, mining engineer, U. S. Bureau of Mines, Mt. Hope, W. Va.; Alex Kelleman, safety director, and C. R. Hoover, assistant chief engineer, Armco Steel Corp., Montcoal, W. Va. Mr. Fitzgerald is president of the chapter, Mr. Howard is secretary.



COAL MEN ON THE JOB . . .

FIATT, ILL., TRUAX-TRAER COAL CO.—Elmer McCann (left), mining mechanic; R. M. Leseney, mechanical superintendent; Floyd M. Cordray, chief electrician; and E. G. Young, General Electric Co.

News Briefs

Chief executives from 48 coal companies have formed the Mid-West Coal Producers Institute, Inc. **Stuart Colnon**, president of the Freeman Coal Mining Corp., was chosen board chairman. Other officers: **A. H. Truax**, president, Truax-Traer Coal Co., Chicago; vice presidents: **J. W. Morgan**, president, Ayrshire Collieries, Indianapolis; **Mark Eastin, Jr.**, president, West Kentucky Coal Co., Madisonville, Ky.; treasurer: **T. L. Kelce**, vice president, Peabody Coal Co., Chicago; secretary, **A. J. Christiansen**, Chicago.

The federal Budget Bureau has reportedly approved a \$700,000 Bureau of Mines building in Mt. Hope, W. Va.

Pennsylvania's Gov. Leader has named the following men to membership on the state's Coal Research Board: **Edward G. Fox**, former head of Reading Anthracite Coal Co., Pottsville; **F. O. Case**, president of Glen Alden Corp., Wilkes-Barre;



White Cottage Coal Company,
White Cottage, Ohio



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The two machines pictured above are part of the equipment used by White Cottage Coal Company in its strip-mining operation. Each works 20 hours a day, seven days a week. Each has given over 14,000 hours of performance without major overhaul. And each uses Cities Service Lubricants—C-300 Motor Oil, Trojan MP 140 Gear oil and Trojan A-1 Greases.

Says Superintendent Ralph Jameson: "That's the amazing kind of results we've been getting with Cities Service Lubricants ever since we first began to use them back in 1942. Today, they keep all of our equipment—shovels, draglines, bulldozers, and 18 dump trucks in top-notch condition. Cities Service products deserve a lot of credit for the efficiency of our strip operation, and I'd recommend them to any strip miner."

Like White Cottage and scores of other coal companies, you'll find Cities Service Lubricants can be an invaluable asset to you. For all the reasons, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



One of 18 Dump Trucks leaves load of stoker coal near railroad siding. White Cottage produces 100,000 tons per year, gives all equipment tremendous work-out to meet this production figure.



Bulldozer Clears Road for other equipment. Like its big brothers, the cranes and shovels, it provides flawless performance with top quality Cities Service Lubricants.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

News Briefs (Continued)

Robert G. Pfahler, coal consultant, Paoli; Joseph Pursglove, Jr., vice-president of research, Pittsburgh Consolidation Coal Co., Pittsburgh; Joseph T. Kershetsky, president, UMWA, District 9, Shamokin; John Seddon, UMWA, District 5, Pittsburgh.

The Georgia Power Co. and the Alabama Power Co. plan to construct a \$150 million steam-electric generating plant on the Coosa River near Alabama's coal fields. Four steam generating units having an output of 1 million kw are expected to be completed in 1963. The location, according to Harlee Branch, Jr., president of Georgia Power, will enable the plant to serve many of Georgia's biggest load centers. Because of transmission improvements, Mr. Branch says, it is now cheaper to bring electricity into Georgia over transmission lines than to transport coal.

The Elkhorn Coal Corp. of Kentucky, an affiliate of Pittsburgh Consolidation Coal Co., will open a mine near Alexander in West Virginia's Upshur County. The company plans to operate under the name, Peerless Sewell Coal Co. and has leased land near Alexander. Expected production is 1,000 tpd. Van B. Stith, Huttonsville, W. Va., who directed operations at the Anchor Coal Co., has been retained as superintendent of the new mine.

The Virginia Coal Operators Association has established a \$300 scholarship at Virginia Polytechnic Institute. The scholarship is open only to high school graduates that live in seven Virginia counties. E. H. Robinson, secretary of the association, is receiving nominations in Norton, Va.

Two coal executives, James D. Ireland, president of the Peters Creek Coal Co., Summersville, W. Va., and Robert D. Cowen, president, Monongahela & Ohio Coal Co., Cleveland, Ohio., have bought the Gauley Mountain Coal Co. in West



NATIONAL AND SECTION OFFICERS who attended the annual summer meeting of the Pennsylvania Anthracite Section, AIME. W. B. Stephenson, (left) chairman, Philadelphia section; W. W. Everett, chairman ex-officio, P. A. S.; Daniel Lyons, chairman, Lehigh Valley section; C. E. Reistle Jr., president, AIME; W. J. Parton, retiring chairman, P. A. S.; D. Mitchell, secretary, coal division; Floyd S. Sanders, chairman elect, P. A. S.; T. R. Weichel, secretary-treasurer P. A. S.; E. O. Kirkendall, secretary, AIME.



HEADS OPERATORS' GROUP—Edward G. Fox, former president of the Reading Anthracite Coal Co., has been elected president of the Bituminous Coal Operators Association, succeeding the late Harry Moses. As his first assignment, Mr. Fox will probably negotiate for a new labor contract with John L. Lewis.

Virginia's Fayette County. The transaction was effective July 10. Gauley Mountain Coal Co., situated at Ansted, W. Va., will be operated under the same name. Mr. Ireland and Mr. Cowen purchased the company independently. Financial details have not been disclosed.

In West Virginia's Gauley coal field near Richwood two closed mines have been activated. Tioga No. 5, located on Strouds Creek-Muddlety RR, formerly operated by the Tioga Coal Corp., has been reopened by the Gauley Eagle Coal & Coke Co. The mine's name has been changed to Gauley Eagle No. 3. The second reopened mine lies in the Sewell coal seam and is known as Turkey Creek No. 2. Formerly operated by the Pike Coal Co., the mine has been taken over by Raymond Floyd, Summersville. The mine's name is unchanged.

A 100,000-kw steam-electric plant is under construction on a bank of the North Platte river at Glenrock, Wyo. The \$20 million development, expected to increase Wyoming's power supply by 50%, will burn coal from the Glenrock field, only 12 mi north of the plant site. The builder is the Pacific Power & Light Co., which says that "good quality" coal seams 25 to 40 ft thick are at hand and can be mined economically by stripping.

Labuco mine, Alabama By-Products Corp., Flat Creek, Ala., which worked 168,513 man hours last year without a disabling injury, has won top honors among bituminous mines in the Bureau of Mines' 31st National Safety Competition for the second straight year. In the anthracite division, Germantown Colliery, Raven Run Coal Co., Centralia, Pa., took top honors after 12 yr of competing
(Continued p 150)

Preparation Facilities

Minersville Coal Co., Minersville, Pa.—Contract closed with the Deister Concentrator Co. for one SuperDuty diagonal deck No. 7 coal washing table for cleaning rice-size anthracite.

Christopher Coal Co., Humphrey No. 7 mines, Madsville, W. Va.—Contract closed with the Deister Concentrator Co. for five Model 108-B Concenco revolving feed distributors for feed distribution to SuperDuty diagonal deck No. 7 coal washing tables.

Ridgeview Coal Co., Ridgeview, W. Va.—Contract closed with the Kanawha Mfg. Co. for a ground

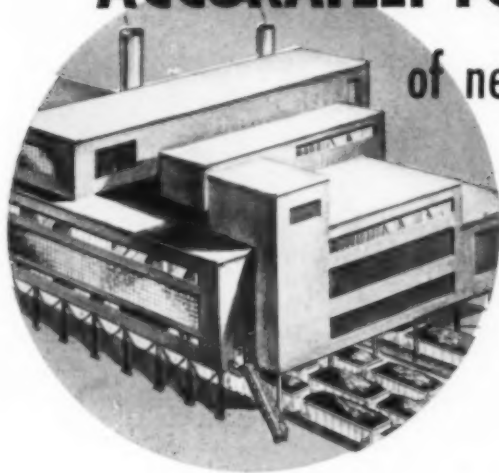
storage system. Live storage: 500 tons; handling capacity to and from storage: 150 tph ROM. Equipment and facilities consist of dump bin for drop bottom cars, 150 ft inclined belt conveyor to storage pile, a stacking tower to build pile, and a recovery conveyor from underneath the storage pile to trucks. Estimated completion, September.

W. P. Stahlman, Corsica, Pa.—Contract closed with the Jeffrey Mfg. Co. for a single-compartment diaphragm jig, an addition to the present washing plant, to wash 6x0 at 150 tph.

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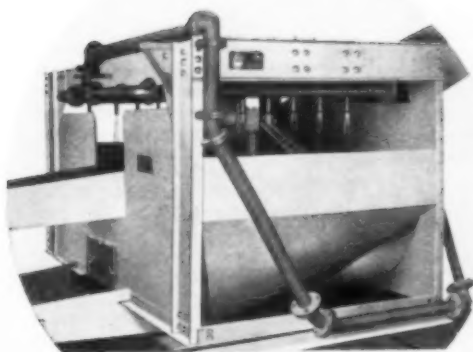


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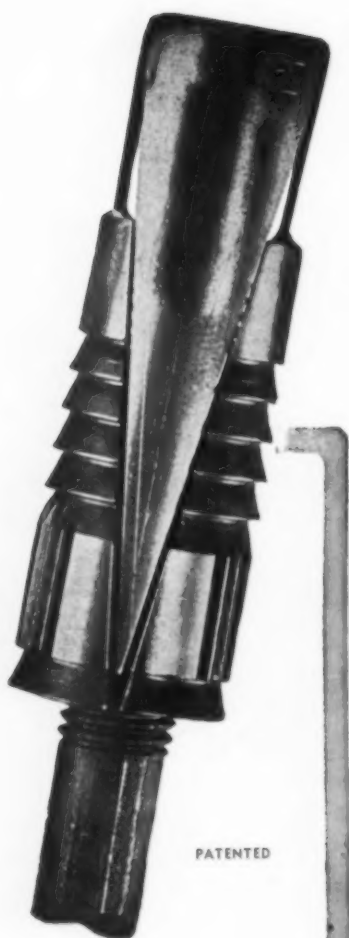


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In Western States

PATTIN expansion shells are available and serviced exclusively through The Colorado Fuel & Iron Corp., Denver, Colorado.



Foreign News

FRANCE

The French expect to import about 18 million tons of coal this year, an increase of 1.5 million tons over 1955. Maurice Lemaire says that the increase is due to a high level of industrial activity in France, particularly in steel. The increased needs are also seen as a consequence of North African hostilities.

WEST GERMANY

Coal and coke exports are to be reduced by 10% or 2 million tons a year. At the same time, because of a steady

Communist China beginning this month, according to Japan's largest steel producer, Yawata Iron and Steel Co. The company disclosed that two representatives will visit Peking to negotiate for the imports.

ITALY

Italy's growing coal requirements, unmet by her own production and productions of the European Coal and Steel Pool, are being met by United States coal. In a complaint to the ECSC, Italy disclosed that during 1955 she was forced to



LARGEST OF ITS KIND in Britain, this 56-ft coal hauler is powered by a 270-hp Rolls-Royce diesel. The 66-ton hauler is mounted on a Euclid tractor and is manufactured by the Eagle Engineering Co., Warwich, England. This one is scheduled to help move 16,000 tons of coal a week from Britain's deepest strip operation at Bedlington, Northumberland.

decrease in domestic coal production and an increasing demand by industry, more coal will have to be imported. Observers in Bonn estimate that the United States will supply 10 to 12 million tons of the 20 million negotiated up to March, 1957, despite the fact that American coal will cost 50% more than domestic. The same observers believe that the United Kingdom and Poland will supply only 3 million tons. Hard coal production in June amounted to 11,513,900 tons against 10,264,400 tons in May.

SOUTH AFRICA

The South African government's \$112 million oil-from-coal plant "Sasol," will produce two qualities of gasoline—a special alcohol blend and a motor fuel similar to that of imported gasoline. In full production, the plant will produce 55 million gallons annually.

JAPAN

The Japanese steel industry wants to import 580,000 tons of coking coal from

increase coal imports by 2 million tons, all of it coming from the United States. Her total imports of coal last year were 6.8 million tons. (Continued)

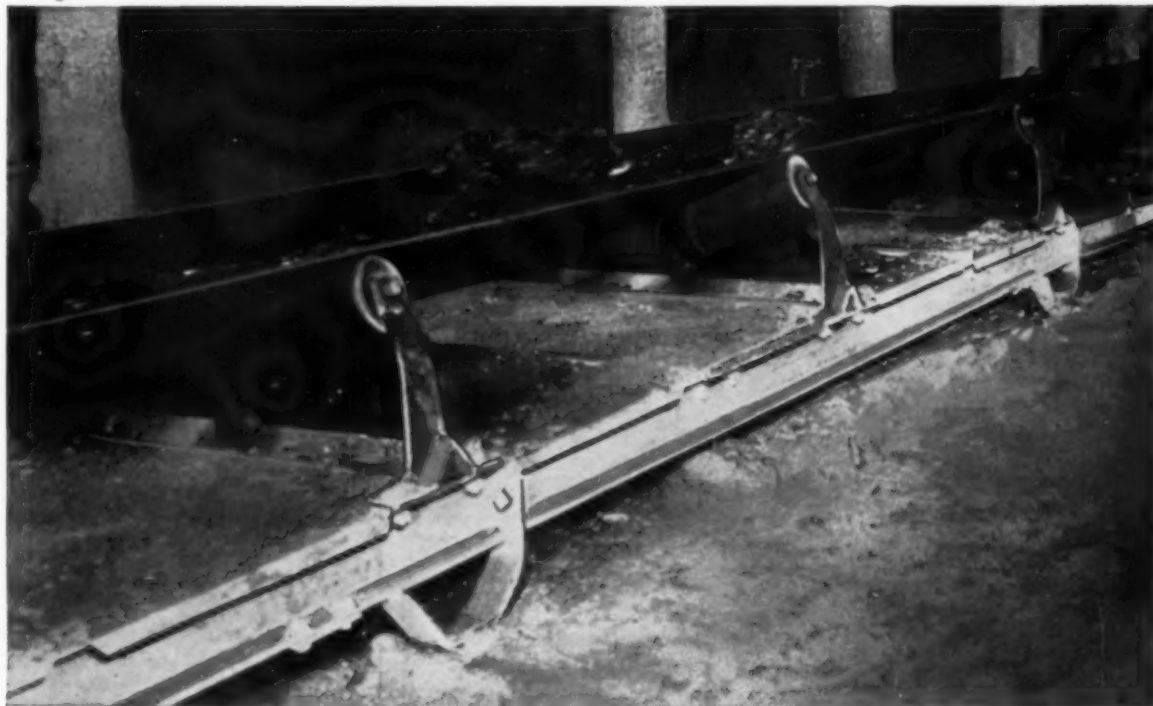
Intensive mechanization and a facts-of-life approach to chopping costs have resulted in the development of huge deposits of Australian brown coal at a rate that has boosted production in the State of Victoria from 5 million tons in 1945 to 10 million tons in 1956. By 1965 output is expected to reach 20 million tons. Larger and larger excavators, bigger rail equipment and a growing use of belt conveyors have helped increase production about 20%. Generally, productivity per man has risen about 50% in 4 yr. In one case it has risen 100%. Next month Alicja Grobtych, McGraw-Hill's World News Correspondent in Melbourne will bring Coal Age readers a full report.

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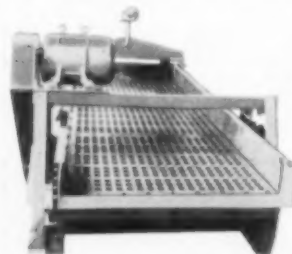
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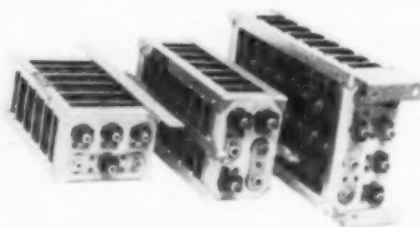
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Foreign News (Continued)

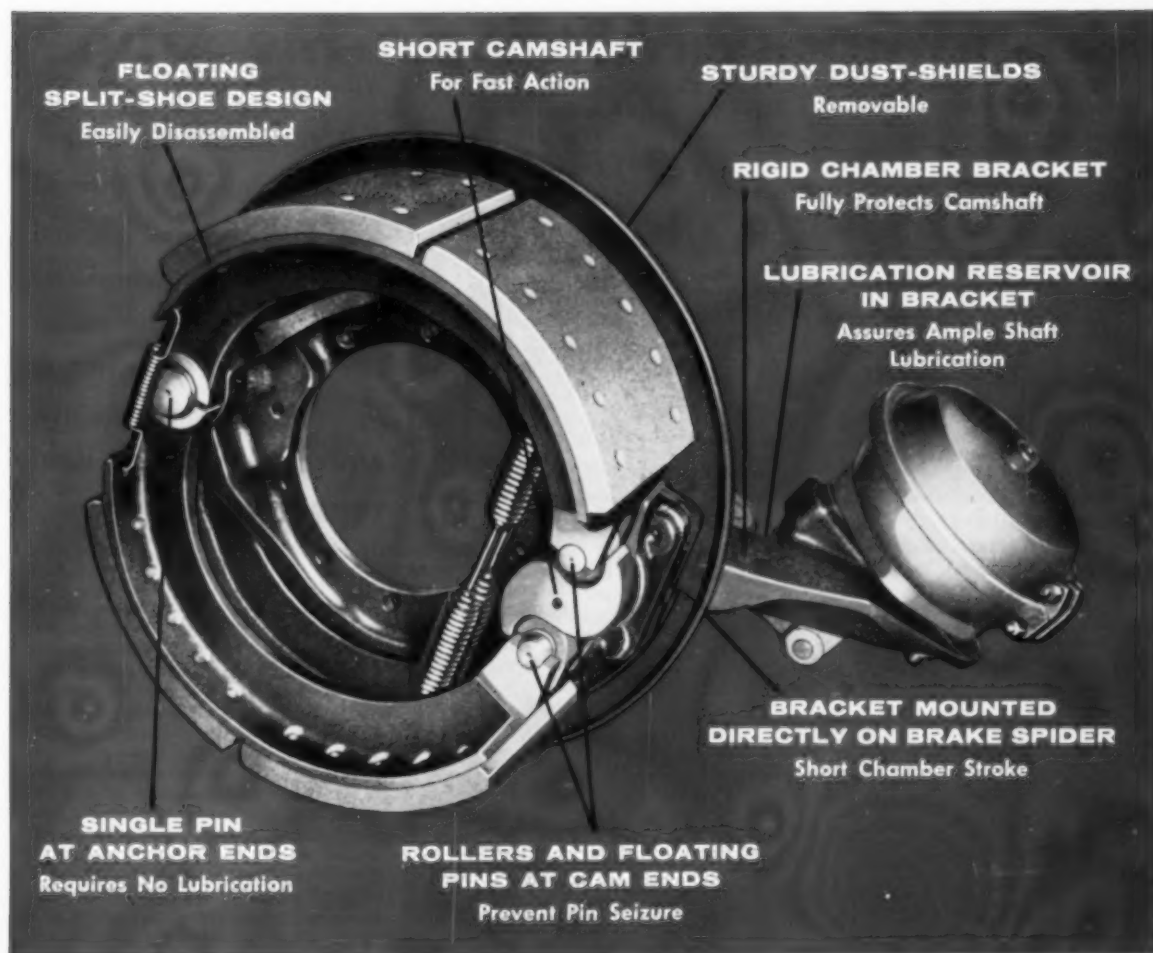
PERU

The Mining Bank, a government department, is carrying out experiments in the manufacture of coal briquettes. After experimenting with a number of binding materials to mix with the anthracite, including starch, the experimenters found that molasses was ideal for the purpose.

GREAT BRITAIN

The Central Electricity Authority states that the Ministry of Fuel and Power will begin to build a nuclear power plant at Berkeley on the Severn Estuary in Gloucestershire, England, early in 1957. The plant will be the twin to one built at Bradwell in Essex. Although the two stations will produce electricity at a price which will compete with electricity from coal, it is becoming apparent that their successors will have a still greater competitive advantage. Recent developments in research laboratories have shown how to increase substantially the power output of stations like Berkeley and Bradwell without increasing their size and cost. The most important development is believed to be the discovery of how to increase the temperature of uranium fuel. In the two stations the temperature of the uranium fuel will not rise above 400 deg C. In the near future however, temperatures of 600 deg C are thought to be feasible. This means that uranium will be burnt at a greater rate, resulting in better use of the same machinery, and resulting in greater efficiency. Another important development is a method of welding steel plate thicker than 2 in. This means that it will be possible to build larger reactor vessels without a corresponding increase in cost. British engineers are now talking of power stations with a capacity of 300 megawatts or more. Berkeley and Bradwell will not have much more than 200 megawatts.

In terms of cost, the advantages of atomic power will be much greater than was imagined as recently as a year ago. It was then thought that an investment of \$336 would be required to provide a kilowatt of electrical capacity, as will be the case at Berkeley and Bradwell. But capital cost in later power stations will be less than \$224 a kilowatt. This means of course, cheaper electricity. British experts once thought that in atomic power stations capital charges would account for about half a cent for each unit of electricity produced, and that even with a conservative estimate of the value of plutonium produced as a by-product, net fuel costs would run at about a quarter of a cent a unit. (These figures add up to about three quarters of a cent a unit—the cost of generating electricity in modern coal-fired power stations near coalfields.) Now however, it seems that the cost of generating atomic power will be rather less than half a cent a unit. It also implies that Britain's atomic energy program can be carried out more quickly.



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52nd Rocky Mountain Meeting



MOUNTAIN BUMPS, MINE FIRES—Fred W. Whiteside (left), institute secretary; Walter Steen, U. S. Steel Corp.; W. J. O'Connor, Independent Coal & Coke Co.; James Westfield, U. S. Bureau of Mines, and R. L. Hair, retiring institute president, Colorado Fuel & Iron Corp.



BOLTING, CHAR PRODUCTION, MAINTENANCE—Edward Thomas (left), USBM; R. R. Williams, Jr.; Colorado Fuel & Iron Corp., session chairman; Leonard Allot, CF&I, and R. T. Hair, Joy Mfg. Co.



CONVEYORS, CLEANUP, PRODUCTIVE MAINTENANCE, POTASH MINING—R. T. Blakley (left), General Electric Co.; C. E. Pressnell, International Minerals & Chemical Corp.; V. O. Murray, Union Pacific Coal Co.; M. D. Ross, Kaiser Steel Co., and L. S. Ahlen, Goodman Mfg. Co.

Glenwood Springs, Colo., is scene of annual conference of western coal operators, with emphasis this year on increasing mine safety and improving operations and maintenance of mechanical equipment.

INCREASED SAFETY through control of mountain bumps and better fire prevention and fire control underground, and improved equipment maintenance through more reasonable treatment of equipment at the face and adequate interest in maintenance from top management were among major topics presented by speakers at the 52nd annual meeting of the Rocky Mountain Coal Mining Institute at Glenwood Springs, Colo., June 17-20. Other features of the program included a description of the extensible rope-belt conveyor, a survey of the various methods of producing low-temperature char; an outline of the safety program and aspirations of the UMWA, and a review of recent developments in roof bolting.

Operating officials in their contributions described methods for recovering Utah coals and for advancing a slope through heavily-caved ground.

In his president's address at the opening session on Monday morning, R. L. Hair, superintendent of coal mines, Colorado Fuel & Iron Corp., Pueblo, Colo., reported a 15% upsurge in Colorado's production in 1955 over 1954, in pointing out that a continuous rise appears in the offing in spite of the claims for the glamorous sources of energy, nuclear and solar. Colorado mines produced 3 million tons in 1954 and 3.4 million in 1955, and production in the western states as a group was up about 10% in 1955. Looking to the future, Mr. Hair declared that although prospects for increases in domestic-heating markets are limited the utilities show some promising possibilities. Furthermore, the chemical industries may soon begin to use more coal.

Chairman of the following technical session was W. J. O'Connor, president, Independent Coal & Coke Co., Salt Lake City, Utah. Speakers and their subjects were Walter Steen, manager of industrial relations, United States Steel Corp., Gary, W. Va., on control of mountain bumps; and James Westfield, assistant director, U. S. Bureau of Mines, Washington, D.

**INDUSTRY MEETING—
A Special COAL AGE
Staff-Written Report**

RMCM Officers—1956-57

C., on fire prevention and fire control.

"Since August, 1953, we have been experimenting with unloading the internal stresses in pillars by augering them before mining."

Thus setting the stage, Mr. Steen, in presenting a paper prepared by Woods G. Talman, general superintendent of the Gary District, U. S. Steel, told the institute that efforts to drill into loaded blocks have been successful, and that bumps have been triggered in all intensities from light to those requiring clean-up of 1,000 tons of coal.

As described in Mr. Talman's paper, the drilling is done from in back of some protective barrier, such as the chain pillar or heavy cribbing, for example. Step-by-step procedures in all the work done to date were outlined in a series of slides, showing locations and lengths of all holes drilled. Mr. Talman's description of these operations appears in the January, 1955, issue of *Coal Age*, p 68.

Emphasizing the seriousness of the problem, Mr. Steen had the sad duty of reporting that a bump in the Pocahontas No. 4 seam at a U. S. Steel operation a few days before the meeting had resulted in fatal injury to three men and serious injury to a fourth. The men had been cleaning up in a room when the bump occurred nearby. Not a single timber, crib or line curtain was disturbed.

"From July 1952 through the year 1955, 120 fires were reported in the Nation's bituminous coal mines. How many fires occurred that were not reported can only be conjectured. Five lives were lost and 33 nonfatal injuries were suffered in the fires reported."

This was the macabre score reported by Mr. Westfield in his review of some recent fires which caused suffering and extensive damage. With respect to origin, 68 of the fires were caused by electricity, 17 by belts, one by acetylene, one by explosives and 33 by a variety of other causes. It is quite evident in analyzing the causes that nearly every one could have been prevented by proper planning and maintenance, Mr. Westfield declared.

Recognizing that some in the industry have attributed spontaneous fires in pillared areas to the use of bleeder openings around such areas, Mr. Westfield pointed out that such fires have occurred in areas where bleeders were not involved. There can be no question that the danger of an explosion is greatly minimized by bleeder openings.

Summing up the reasons why fires get out of control, Mr. Westfield finds that lack of training in fire-fighting procedures is a principal factor. The industry spends millions of dollars for modern mining equipment, but there is a serious question as to whether enough is spent on training men to fight incipient fires as a protection for this investment. Most mines have well-trained maintenance crews to keep the equipment operating because outages of

President: **John Peperakis**, manager of mines, Kaiser Steel Corp., Sunnyside, Utah.

Vice presidents: For New Mexico, **Ivan J. Kinter**, district manager, Kennametal Inc., Carlsbad, N. Mex. For Utah, **W. J. O'Connor**, president, Independent Coal & Coke Co., Salt Lake City. For Colorado, **J. A. Setter**, district manager, General Electric Co., Denver. For Montana, **E. L. Chistensen**, mining engineer, USBM, Billings. For Wyoming, **Lyman Fearn**, state coal mine inspector, Rock Springs.

EXECUTIVE BOARD: For New Mexico, **C. E. Pressnell**, general superintendent, International Minerals & Chemical Corp., Carlsbad, and **Oscar Huber**, president, Albuquerque & Cerillos Coal Co., Madrid.

For Utah, **D. F. McElhattan**, district manager, Mine Safety Appliances Co., Salt Lake City, and **O. A. Troseth**, mining engineer, Spring Canyon Coal Co., Spring Canyon.

For Colorado, **K. F. Eaton**, sales engineer, Anaconda Wire & Cable Co., Denver, and **F. S. Leonard**, mine inspector, Colorado Fuel & Iron Corp., Trinidad.

For Montana, **S. H. Clarke**, secretary-treasurer, Roundup Mining Co., Roundup, and **Victor Forstrum**, superintendent, Johnson Coal Co., Roundup.

For Wyoming, **W. T. Steinhour**, superintendent, Gunn-Quealy Coal Co., Rock Springs, and **Robert F. Yourston**, safety engineer, Union Pacific Coal Co., Rock Springs.

Secretary-Treasurer: **Fred W. Whiteside**, consultant, Denver, re-elected.

even a few minutes duration are expensive. Yet, extensive fire damage to equipment or property can be much more costly than mechanical or electrical breakdowns.

It is hardly conceivable that a trained man would request a fan reversal while other men in the mine are endangered by a fire, which actually happened in one instance reviewed by Mr. Westfield. It is recommended, therefore, that all supervisors and 10% of the men on each shift be thoroughly trained in fighting mine fires.

Lack of adequate equipment is another reason why fires get out of control. This includes improperly located equipment and empty or corroded extinguishers. Many mines maintain water lines having 100 psi at the face. On testing or in an emergency, however, some of these would not deliver for more than a moment a nozzle discharge of 50 gpm, the recommended minimum.

Char production, maintenance and roof-bolting developments were key topics at the Monday-afternoon session, with **R. R. Williams Jr.**, manager of mines, CF&I, Pueblo, presiding. Following is a review of proceedings at this session.

"During the early years of this century, literally hundreds of low-temperature carbonization processes were developed. Some of these never passed the 'paper' stage, some were tried in laboratory- or pilot-size units and some commercial plants were built."

This was the introduction to a survey of carbonization processes which was prepared for the institute by **John D. Price**, superintendent, coal and coal chemicals dept., CF&I, and presented by **Leonard Allott**, chief chemist at the CF&I coke plant, Pueblo. Using slides to show distinguishing characteristics of 11 representative processes, Mr. Price stressed the point that selection of a process must be based on the nature of the coal to be carbonized and on the end use for which the products are destined. CF&I interest in

the matter centers about a search for a carbonization method that will permit the use of char made from non-coking western coals that can be substituted for low-volatile coals in blending coke-oven charges.

With this goal in mind, CF&I officials have laid down the following major requirements which must be satisfied by the retort finally selected:

The resulting char must make a satisfactory grade of coke; the satisfactory use of the coke in the blast furnaces being the criterion of its quality.

Agitation of the coal within the retort appears desirable to prevent caking and to insure efficient, uniform heating.

Retort should have as few interior projections as possible to prevent build-up of carbonaceous material.

The process of feeding coal and discharging char should be continuous.

Access to the interior of the retort for cleaning and inspection should be easy.

Heating controls should be adequate to permit handling of different grades of coal and production of the desired quality of char, and the retort should be efficient in fuel consumption.

Closely-sized coal should not be required and removal of fines from feed coal should not be necessary.

Retort should have a relatively high rate of daily throughput to limit the number of units required.

"Loader booms should not be used as derricks, and shuttle cars should not be used as post pullers."

Some practices which may be good temporary expedients can become bad standard practices, and many expedients have a way of becoming standards, was the theme of the second Monday-afternoon feature, presented by **R. T. Hair**, manager of sales—coal industry, Joy Mfg. Co., Pittsburgh, Pa. Particular emphasis was placed by Mr. Hair on some do's and don'ts, as follows:

Don't tamper with hydraulic relief valves. It is relatively easy to adjust a

relief valve to compensate for worn components in other parts of the circuit, but it is equally as easy to forget to reset the valve after repairs are made.

Don't use jumpers to solve electrical failures, since this often contributes to further failures.

Don't use old cable as feeders.

Do replace hydraulic hoses with duplicate types.

Don't tolerate underinflation of shuttle-car tires. Most useless tires are victims of sidewall damage, not tread wear.

Think twice before filling tires with water, since this can lead to transmission of all road shocks to the frame of the unit.

Don't plug motors if they're not designed for such service.

Don't weld where bolts are called for.

Don't settle for two capscrews where six are needed.

In short, Mr. Hair said, Run your maintenance program, don't let maintenance run you.

Final feature of the day's program was a survey of recent developments in roof bolting by Edward M. Thomas, chief, roof-control section, USBM, College Park, Md. The full text of Mr. Thomas' paper appears in this issue of *Coal Age*, beginning on p 85.

Presiding at the Tuesday session was V. O. Murray, vice president in charge of operations, Union Pacific Coal Co., Rock Springs, Wyo. First offering was a film entitled, "Up From the Bed of a Desert Sea," presented by C. E. Pressnell, general superintendent, International Minerals & Chemicals Corp., Carlsbad, N. Mex. By way of introduction, Mr. Pressnell pointed out that potash mining now represents a capital investment of \$80 million and provides employment for 4,000 persons having a monthly payroll of \$1.5 million. About 3 million tons of finished product is turned out annually. The soundfilm explained the formation of potash deposits, how the mineral is mined (using a number of units developed for coal mining, such as loading machines and shuttle cars) and how the industry contributes to the community life of Carlsbad.

"Chain-link idler is one of the more important features of the rope-belt conveyor because it permits greater flexibility."

The past decade shows a continuing trend toward concentration followed by the development of continuous mining, making it necessary that some form of extensible transportation be provided, Louis S. Ahlen, district manager, Goodman Mfg. Co., Terre Haute, Ind., said in leading into a description of the Goodman Ropex conveyor. Development of the unit began at an Illinois mine, where an experimental model was built and improved throughout 1955. The production model now in use consists essentially of two parallel wire ropes supported on pipe stands. The chain-link idler assemblies are suspended from the ropes to carry the loaded run of the belt. The pipe stands also provide straight return rollers for the bottom run of the belt.

In making the unit extensible, the parallel ropes suspended between a head-end drive unit and a self propelled tail

assembly which follows the mining machine. The ropes are wound on drums on the tail assembly to be paid out as the tail unit follows the advance of the face. Nothing in the design of the conveyor is rigid. Therefore, there is little impact on the structure.

When used in a permanent Ropex installation, the conveyor can be extended at a rate of about 150 ft in 6 man-hr, against a similar extension in 30 man-hr for a conventional conveyor, Mr. Ahlen said. Similar labor savings are possible in removing the conveyor. Other advantages include (1) less space required underground for storage of conveyor supplies and (2) the substantial reduction in impact permits the use of lighter belting.

"Surplus steel landing mat, bolted to the high ribs, provides more bearing area in cleaning a heavy cave in the Sunnyside No. 3 slope."

M. D. Ross, mine foreman, Sunnyside No. 3 mine, Kaiser Steel Corp., Sunnyside, Utah, described the rehabilitation of a heavily-caved slope, where to date 500 ft has been cleaned up including 300 ft through an extremely bad area. The cleanup procedure involved three steps, as follows:

1. Work over the top of the caved material to provide clearance for bolting the roof without staging.

2. Make another pass through the area, taking from 10 to 15 ft of the fallen material and loading it out.

3. Making a third pass to remove enough fallen material to bring the slope to the required grade.

In the first step, the roof was bolted with 1-in by 10-ft bolts, installed on centers often not more than 1 ft apart. When the cleanup had been completed and the slope brought to grade, the construction of a concrete lining was undertaken. Footings 3 ft wide were poured along both sides and 1-ft-thick walls and roof were built up using heavy reinforcing rod throughout. Ready-mixed concrete at a rate of 1.6 cu yd per ft of tunnel was used to build the tunnel.

Final step in the projects consists of backfilling over the concrete liner to provide additional support to the high ribs and the roof. The project is one phase of Kaiser's program for bringing Sunnyside No. 3 back into production. A prior phase had been the removal of 2.5 billion gal of water from the workings.

"In other continuous-process industries, such as electrical manufacturing, steel, textiles and paper, experience shows that the difference between profit and loss is governed by effective maintenance, as reflected by the frequency of unscheduled breakdowns."

Discussing the matter of "productive maintenance," R. T. Blakley, sales engineer, General Electric Co., Salt Lake City, Utah, pointed out that the true cost of downtime, direct and indirect, should be the major factor in setting up a maintenance budget. Downtime cost should include the value of lost production, idle time of the producers involved and fixed overhead costs in addition to the direct material and labor costs for repairs. Conservative estimates of total cost in mining

runs as high as \$250 per hour of downtime, Mr. Blakley said.

If the coal industry simply follows the trend of American industry, maintenance expense is expected to double in the next 10 yr, as a result of increased mechanization. Naturally, maintenance expense will represent more of total mine cost, thus directly affecting profits. However, effective maintenance is not merely a matter of increasing the maintenance budget, since in a program that is too elaborate the expense may exceed the savings.

Five steps in setting up a productive maintenance program were listed by Mr. Blakley, as follows:

1. Gather complete equipment data. Many do not know what they have in equipment nor where it is.

2. Evaluate for routine maintenance. Determine the relative importance of each machine and base your routine upkeep on this factor.

3. Establish a routine operating system. Keep records of parts numbers and stock levels, keep a running check on frequency of inspection and servicing and record all repairs that have been made on any machine.

4. Evaluate for critical maintenance. If failure of the machine will stop production, if it represents high capital investment and if failure will endanger the health or safety of employees, the unit should be considered a critical one and should receive the best possible maintenance.

5. Establish a critical maintenance program. The extent of an overhaul program must be based upon cold economics. Sometimes it may be better to operate to the point of failure, but not in the case of critical machines.

Presiding at the final session on Wednesday was R. M. von Storch, general superintendent, coal mines and quarries, Columbia-Geneva Steel Div., United States Steel Corp., Dragerton, Utah.

"Operators should closely read the citations of Federal inspectors. If there is any disagreement, an appeal should be made to the safety board of review to contribute to a record of good precedents."

This advice was offered by Charles Ferguson, director, Safety Div., United Mine Workers of America, Washington, D. C., in his review of the safety program of UMWA and the union's plans for future participation in safety activities. Setting the theme of his remarks, Mr. Ferguson declared that safety interest within UMWA is not something that occurred only within the past few years. Recognition of the need for increased safety appears in the preamble to the union's constitution. Achieving these ends has been a struggle, but a change in the thinking of operators resulted in 1941 in the establishment of safety committees as a contract provision, Mr. Ferguson said.

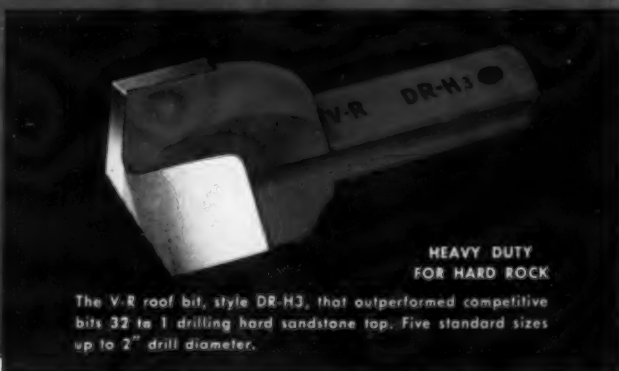
Adoption of the Federal Mine Safety Code in 1946 was another milestone, since it was at this time that copies of Federal inspectors' reports were directed to union safety officials for their review and comment.

Turning to the operations of the UMWA safety division, Mr. Ferguson related that his office is in contact with



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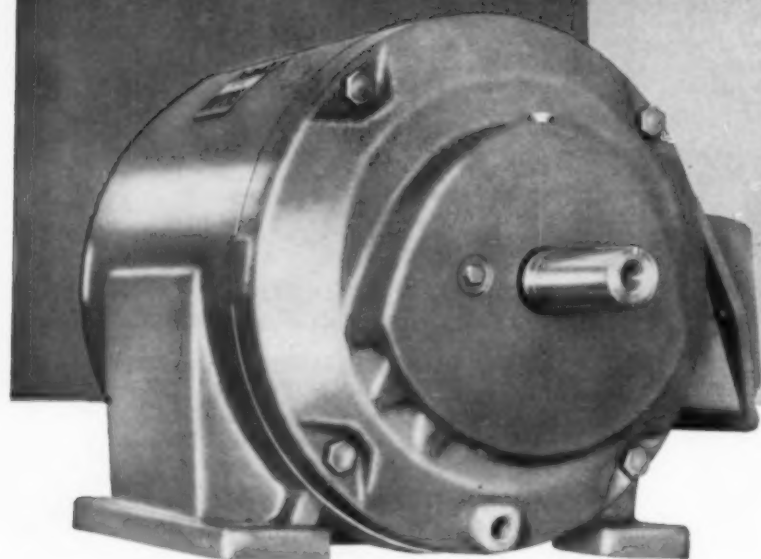
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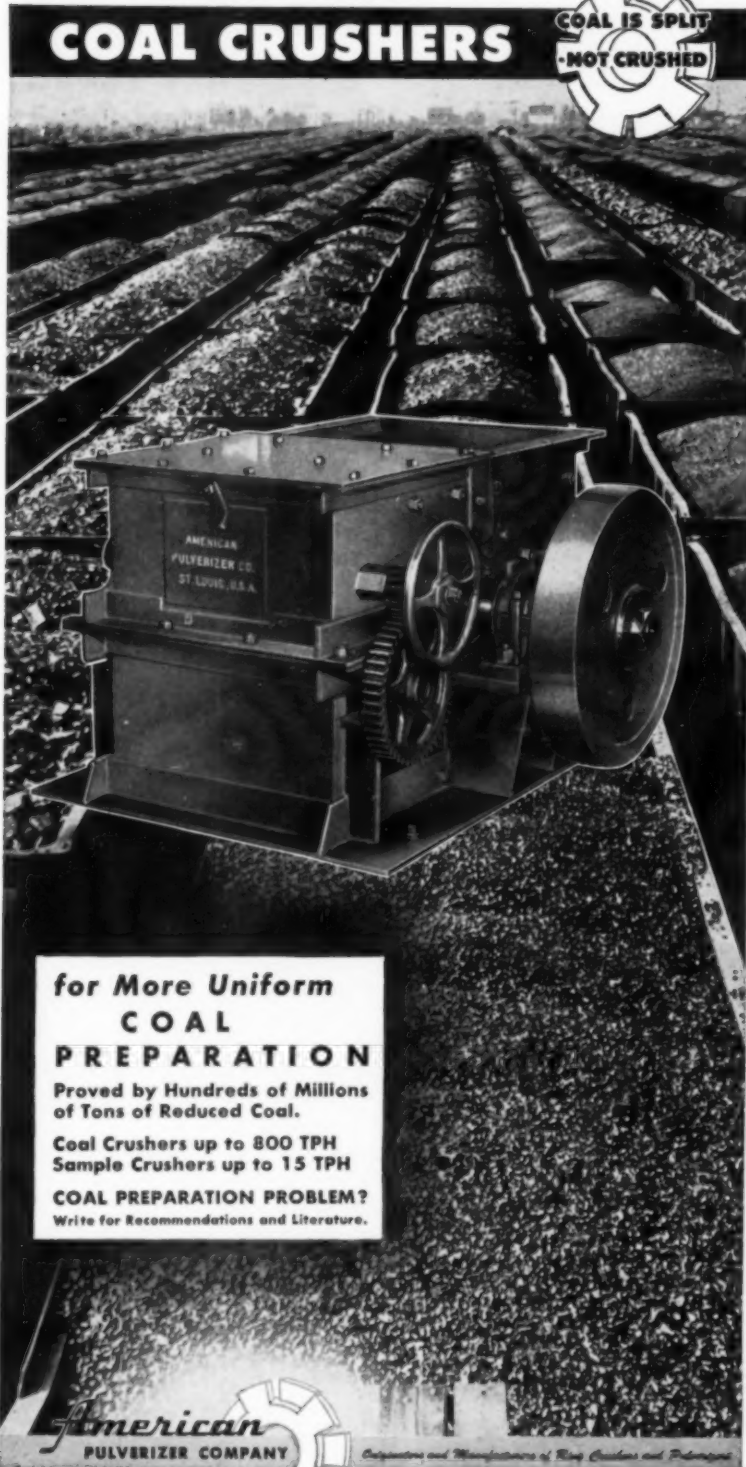
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Rocky Mtn. Meet (Continued)

some 8,000 mines in the Nation, including the largest operations and those employing only a few men. There is no attempt to be nasty in corresponding on safety matters with the operators, Mr. Ferguson said.

Since about 85% of mine accidents are preventable, the union is vitally interested in promoting effective educational programs for mine workers. Late reports show that 142,000 men have participated in the accident-prevention training offered by the Bureau of Mines, with 250 locals and one entire district showing 100% completion. Accidents have been substantially reduced, and follow-up training now is being planned. Recalling Mr. Westfield's remarks to the institute on the need for trained fire fighters, Mr. Ferguson agreed that this might offer an opportunity for further training.

In matters of legislation, the union will continue to press for more favorable safety laws, and it is hoped this can be done cooperatively. As a case in point, Mr. Ferguson told of experience in the State of Indiana, where a new state mining law was offered to the legislature as an "agreed" bill, which had been written with legal advice by representatives of the union, the state and the operators.

Suggestions for improving the safety spirit of the men include (1) give formal recognition to the men at the face for outstanding safety records, (2) invite men to speak at Safety Day rallies, which has been successfully done in Virginia and (3) advise employees beforehand of coming technological changes, especially where matters of safety are involved, Mr. Ferguson advised.

Speaking as an operator, Chairman von Storch agreed that the record is not satisfactory, but improvement is evident and this has come about through cooperative effort.

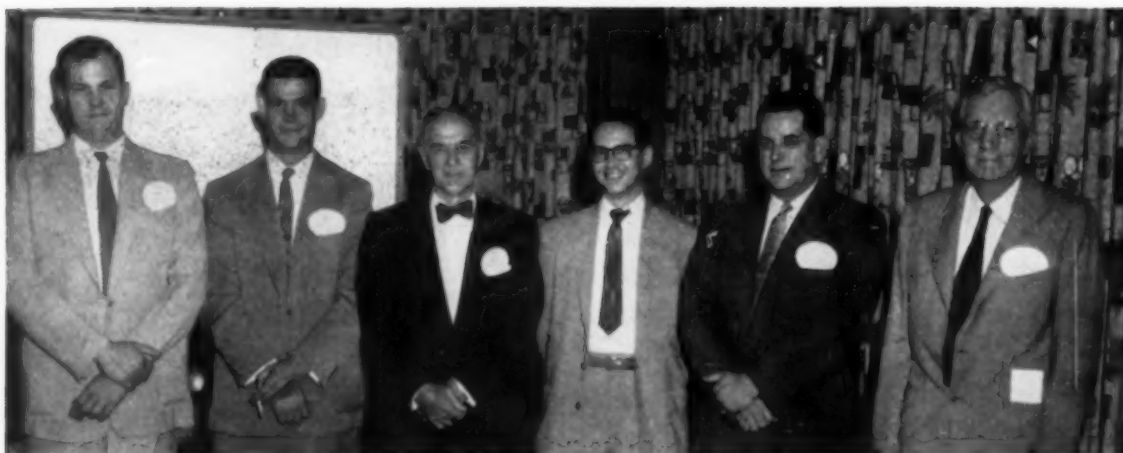
"We're limiting our mine to a size that can be served by a 300-kw rectifier."

In a humor-filled description of operations at his company's mine, E. S. O'Connor, president, Book Cliffs Coal Co., Salt Lake City, related that the mine was opened in 1950 in 320 acres of the Lower Sunnyside seam to produce about 70,000 tons per yr. The seam is from 12 to 14 ft thick, but only the cleaner coal above a binder 1½ ft from the floor is mined. Two mechanical units are equipped with 11-BU loading machines and 10-SC shuttle cars as major units.

The single main entry is 3,000 ft long, this development work being completed before room work began. Rooms now are worked up to 10% pitch from the entry to bring the panel back, thus leaving troubles behind, Mr. O'Connor said.

The mine is dry, good ventilation is relatively easy to get and the lack of "brass" helps keep costs down, Mr. O'Connor said with a smile.

The program closed with a color sound-film of the operations and facilities of the Kaiser Steel Co., which was prepared by the company for use as a report to employees. Tom McCourt, superintendent, Mines No. 1 and No. 3, Kaiser Steel, Sunnyside, Utah, presented the film.



FRIDAY MORNING—Charles Howard (left), the Trullite Corp.; Elza Burch, Island Creek Coal Co.; E. C. Carris, consultant; L. E. Gillenwater, State Water Commission; H. M. Tibbs, Truax-Traer Coal Co.; H. A. Jones, Carbon Fuel Co.

West Virginia Institute Holds

Preparation, safety and production problems
canvassed at Huntington sessions

PREPARATION PROBLEMS, safety, roof control, underground power, and belt conveyors were major topics at the spring meeting of the West Virginia Coal Mining

Institute, Huntington, W. Va., June 22 and 23. H. A. Jones, general superintendent, Carbon Fuel Co., Carbon, W. Va., presided at the Friday luncheon. J. W.

Woomer, J. W. Woomer Associates, Pittsburgh, Pa. was guest speaker. Harry G. Kennedy, secretary, Kanawha Coal Operators Association, Charleston, W. Va., was toastmaster at the dinner. Guest speakers were Cecil Underwood, Republican nominee, and Robert Molloyhan, Democratic nominee for governor of West Virginia.

Speakers and their subjects at the Friday morning session were: L. E. Gillenwater, assistant executive secretary, State Water Commission, Charleston, W. Va., on stream clarification progress in West Virginia; E. C. Carris, consultant, Charleston, W. Va., and Elza Burch, assistant director of preparation, Island Creek Coal Co., Holden, W. Va., on modern methods of solids recovery from cleaning plant effluent; and Charles Howard, president, The Trullite Corp., Ceredo, W. Va., on sintering refuse for lightweight aggregate. H. M. Tibbs, manager, Truax-Traer Coal Co., Kayford, W. Va., presided at the session.

STREAM CLARIFICATION

Silt carried by West Virginia streams comes from soil erosion and industrial wastes, Mr. Gillenwater remarked, in reporting on stream clarification progress in West Virginia. Silt loads resulting from soil erosion are usually heavier during periods of heavy rainfall, and a stream with this type of silt can be expected to clear in a few days. But a stream receiving uncontrolled coal washery waste can never



FRIDAY AFTERNOON—C. B. Peck Jr., Anaconda Wire & Cable Co.; C. T. Holland, Virginia Polytechnic Institute; R. G. Lazzell, Island Creek Coal Co.; Julius Olzer, West Virginia Department of Mines; and Harry Gandy Jr., National Coal Association.



SATURDAY MORNING—G. Fitzgerald, USGS; W. A. Hanson, Joy Mfg. Co.; E. W. Potter, Royalty Smokeless Coal Co.; and F. R. Morrow, Kaiser Aluminum.

Technical Meeting

be expected to clear itself. Therefore, steps must be taken to prevent the discharge of these wastes into the stream.

Coal-washer waste does not constitute a public health hazard, Mr. Gillenwater continued. Objection arises from the discharge of black suspended particles which may be carried far and deposited in pools. These are flushed out during periods of high water and leave unsightly, damaging deposits along the shore.

In areas where coal mining is the predominant industry, the Water Commission feels that the clarification of washer wastes is the key to over-all pollution abatement, Mr. Gillenwater explained. It has been demonstrated that once the coal companies begin work on waste disposal systems, the residents take interest in preventing the dumping of trash and garbage into the streams, and the towns take a more active interest in sewage disposal.

The Water Commission has set no effluent standards, Mr. Gillenwater declared. The only water quality objective established has been to call for substantially complete removal of settleable solids and not less than 45% removal of suspended solids. Since the program is co-operative, no rigid policies have been set regarding how pollution abatement is to be accomplished.

In summing up the progress in pollution abatement since 1953, Mr. Gillenwater said that there were 201 preparation plants operating on July 1, 1953. Adequate waste control facilities were installed in 21 plants; 26 had inadequate facilities; 4 had adequate systems under construction; 5 were in the planning stage; 22 had no waste-control equipment; and the needs of 116 were undetermined. As of June 19, 1956, with 201

plants in operation, 65 had adequate control facilities; 9 had no control equipment; the needs of 13 were unknown; 19 had control facilities under construction; 52 had plans for control; and 43 had no facilities.

SOLIDS RECOVERY

In describing modern methods of solids recovery from cleaning-plant effluent, Mr. Burch used Island Creek Coal Co.'s Bradshaw No. 6 plant as an example. His discussion was essentially the same as that given by Matthew Turkovich, director of preparation, Island Creek Coal Co., at the Mining Congress in Cincinnati and reported in *Coal Age*, June, p 160.

With the aid of slides, Mr. Burch explained that the system at Bradshaw No. 6 includes mechanical dewatering, two-stage cyclones, vacuum filtering, heat drying and recirculation of water.

In brief, the coal is processed as follows: raw 3/8x0 is delivered to the fine-coal plant at the rate of 130 tph. It is wetted with overflow from the cyclones before delivery to Heyl & Patterson distributors feeding two sets of wet tables, each made up of six Deister No. 7 tables. Clean coal passes to a sump and is pumped to a double-deck Robins Eliptex screen that dewateres and separates the coal into 3/4x1/2, 1/2x28M and 28Mx0 fractions.

The 3/4x1/2 flows to a 10-ton surge bin before passing to two Flash dryers. The 1/2x28M, containing 25% moisture, is delivered to two Reineveld centrifugal dryers that reduce the moisture content to 6 1/2 to 7%. It then is carried to the 10-ton bin feeding the heat dryers. Effluent is recirculated.

Underflow from the dewatering screens

flows to a battery of Heyl & Patterson 14-in cyclones. Underflow from the cyclones passes to an 8-disk Einco vacuum filter. The filter cake also is sent to the Flash dryer for final dewatering. Cyclone overflow is used to wet the raw 3/4x0 before it is fed to the Deister tables. An average of 25 tph is recovered by the vacuum filter, Mr. Burch said.

Table refuse passes to a refuse drag conveyor where the minus 1/2-mm material is removed and delivered to a battery of cyclones. Cone overflow, containing 1% solids, is pumped to a 1/2-acre settling pond. Underflow is carried to refuse.

To illustrate the trend in solids recovery, particularly in narrow valleys, Mr. Carris used a series of slides showing various equipment combinations that can be used successfully. He said the trend seems to be definitely toward cyclones.

Another worthwhile method is application of a heavy duty horizontal vibrating screen capable of holding a thick bed of material, Mr. Carris added. With this unit, a cake builds up on the screen and acts something like a mechanical filter. The method is satisfactory for 1/4-0 coal and works like this: coarse coal is pumped to the back portion of the screen and permitted to build up into a bed; then underflow from the screen is pumped to cyclones. Cyclone underflow next is delivered to a feed box over the vibrator and spread gently over the built-up bed. About 75 to 80% of the fines are recovered by this method. It also is possible to use two-stage cyclones with this method.

Oil flotation is going to get into the fine-coal recovery field, Mr. Carris observed. The reasons it has not been used in the past is because of the high cost and "temperamental" operation. A turnkey job in oil flotation runs \$6,000 per ton-hour of dried coal recovered. The process not only cleans fine coal but also leaves a milky tailing that can be handled.

SINTERING REFUSE FOR AGGREGATE

There were only 10 lightweight aggregate plants operating in 1945, but by 1955 the number had grown to 84, Mr. Howard said, in opening his talk on sintering washing plant refuse for lightweight aggregate. The industry grew rapidly after the war when the sources of cinders for block manufacture were dried up and companies were forced to turn to a lightweight aggregate.

The Truax-Traer Coal Co. became interested in the manufacture of lightweight aggregate as a method of solving the refuse disposal problem at the Ceredo plant. Approaches to solving the problem included possible rewashing of the refuse; fusing into slag; and manufacturing lightweight aggregate. The first two possibilities were rejected and research effort was concentrated on developing a satisfactory method of making lightweight aggregate, Mr. Howard said.

After research in various methods of making the lightweight aggregate, Mr. Howard said the company decided to try burning it on a traveling-grate stoker. A cooperative research program was carried out with the USBM and in 1955 the plant

went into operation under the new plan.

Employing 6 men, the plant operates 7 days per week and 3 shifts per day while producing 3 tons of aggregate per hour. The success of the initial operation prompted the company to plan expansion of the plant to 12 tph of capacity.

The process is not a universal cure-all for the refuse problem, Mr. Brown warned. To make a satisfactory lightweight aggregate, there must be a definite relation between the quantity of combustible material in the refuse and the fusing temperature of the material. A description of the process appeared in (*Coal Age*, November, 1955, p 78)

Speakers and their subjects at the Friday afternoon session were Harry Gandy Jr., director, Department of Safety, National Coal Association, Washington, D. C., on roof-fall accidents; C. T. Holland, head, Department of Mining Engineering, Virginia Polytechnic Institute, Blacksburg, Va., on permanent support of overburden on coal beds; and C. B. Peck Jr., manager, industrial sales, Anaconda Wire & Cable Co., New York, N. Y., on trends in underground power. Co-chairmen of the session were R. G. Lazzell, development and research engineer, Island Creek Coal Co., Huntington, W. Va., and Julius Olzer, chief, West Virginia Department of Mines, Charleston, W. Va.

ROOF-FALL ACCIDENTS

It is a direct moral and legal obligation of management to participate in all phases of safety, at least to the same degree that top management participates in the direction of production. Aside from the humane standpoint, the cost of machines, transportation, labor, materials, etc., are all a part of the over-all cost of coal. Based on such figures as are available, varying between 15 and 35¢ per ton, accident costs should be given the same consideration, since the saving of money through accident-prevention has the same direct economic effect as an increase in production efficiency, Mr. Gandy remarked.

The U. S. Bureau of Mines and the West Virginia Department of Mines have recently moved forward with the organization of a proposed roof-control program for the State of West Virginia, Mr. Gandy said. The projected program has in Southern West Virginia been taken to top management through at least eight local coal associations and, in the very near future, will be explained to representatives of management and labor in the northern part of the state. The safety division of the International Union and the three-districts in West Virginia are co-operating fully and, after full discussion and study of initial proposals, it is planned to have a state-wide meeting attended by management representatives from each of the operators' associations, International and district union representatives, the combined safety directors, and state and Federal officials for putting into effect the detailed program as agreed upon.

After explaining the program, Mr. Gandy said that any campaign of the size contemplated must move forward

step by step. Each of the ideas, if carried out in a practical manner, can go a long way toward beneficial end results. Possibly some of the plans are impractical in some places, and it is entirely possible that the burden of complete promotion would detract from the results that might be obtained by using a few of the ideas. Nevertheless, everyone should give his full co-operation and support.

On the question of safety discipline, Mr. Gandy said that as a result of a number of co-operative meetings, plans are moving forward to bring into being some method of stopping individual safety violations. Representatives of companies and the union realize the necessity for the proper administration of such disciplinary rules for, if carried forward as they should be, they would be a marked deterrent to accidents and give protection to all underground employees.

Management's responsibility to provide a safe place to work requires more than simply physical or material accident prevention practices. There must be generated and steadily maintained what one might call "safety climate."

This need for a good safety climate cannot be over-emphasized, Mr. Gandy declared. Where it does not exist it is apparent that top management or the employees are either indifferent to safety or merely paying lip service to accident prevention.

To build a proper safety climate, Mr. Gandy explained, management must have the full co-operation of the union and the individual worker. Each must hold up his end of the triangle. There can be no blockage of communications, no attitude of "let the other fellow do it," no abrogation of the mutual responsibility for safety. Management cannot afford it because of its legal and moral obligations to its employees and because of its heavy investment in trained manpower and in equipment. The union cannot afford it because it is obliged to promote the welfare of union members. The individual worker cannot afford it because his good right arm, and possibly his life, are at stake.

SUPPORTING OVERBURDEN

The problem of permanent support of overburden on coal beds has not been solved, but progress has been made, Prof. Holland said. In many instances, valuable buildings, roads and towns must be supported. In the past, it has been the usual procedure to try what somebody else did in a similar situation. Such a solution may or may not work.

There are two ways to support overburden, by backfilling and by leaving sufficient coal. Since there usually is some subsidence where backfilling is used, the only way to support the overburden is by leaving enough coal, Prof. Holland emphasized.

The strength of a pillar varies as the square root of the width and inversely as the thickness of the bed. To date there has been no relationship established between the strength of a laboratory specimen used to measure physical properties and that of an actual pillar, Prof. Holland explained.

In general, it has been found that the strength of a pillar is equal to a coefficient divided by the square root of the volume. By mathematical approximation, the formula can be used as follows for finding the unit strength of a pillar: unit strength, in psi, equals the coefficient of the bed multiplied by the square root of the width of pillar in inches, divided by the thickness of the pillar in inches.

The strength of the bottom rock is an important factor in supporting the overburden, Prof. Holland said. In many cases, the bearing values used by civil engineers are too low. Bearing strength depends on the internal angle of friction.

With the aid of mine maps and tabular data, Prof. Holland cited many examples of how the overburden was supported in various areas. Much of the data verified the conclusions learned from laboratory study. However, Prof. Holland said there is need for more research, particularly in gathering data from active mines that are supporting the overburden. If sufficient information of this type is made available, enough data can be assembled to determine definitely how much support should be left.

UNDERGROUND POWER

Each step in increased mechanization has brought about an increase in the quantity of electrical energy used in mines and more electrical problems, Mr. Peck declared in opening his discussion of trends in underground power. Power consumption in mines is up 75% since the end of the war and the problem of transmitting power economically has increased with increased mechanization.

A continuous miner often uses as much power as a complete section in an old mine. Thus higher voltages are needed to deliver the greater quantities of power. Higher voltages make it possible for equipment to be lighter, more mobile and lower in cost, Mr. Peck remarked. New mines should consider using 440 v AC because equipment is becoming larger and trailing cables also are becoming heavier—as much as 4 lb per foot. However, with AC power, voltage regulations are much more vital.

Higher voltages for primary power also are becoming more popular, Mr. Peck noted. Some mines have used 15,000 v on the primary side, but this is not recommended unless it is necessary to transmit power over a long distance. Splicing, handling and terminating problems arise with 15,000-v power and workmanship must be good.

When figuring power cable for a new job, the copper size should not be figured too close, Mr. Peck warned. It is almost a certainty that conditions will change and the load increased.

On the subject of copper vs aluminum conductors, Mr. Peck said that in portable cables aluminum does not have much application because it lacks fatigue values to resist the bending that takes place in a trailing cable. Aluminum is best suited for power transmission, but some advantage is lost because of the cost of additional rubber needed to cover the larger conductor. Splicing is a problem and the elasticity of aluminum is not as good as copper. Pressure-type connections also

are needed to prevent oxidation at junctions. It is possible to buy 3 ft of equivalent aluminum conductor for the price of 1 ft of copper and in spite of the many disadvantages cited, the savings are about two to one for installed conductors.

Speakers and their subjects at the Saturday morning session were Ford R. Morrow, public relations manager, Kaiser Aluminum and Chemical Co., Ravenswood, W. Va., on more power to aluminum; Gerald Fitzgerald, chief topographic engineer, USGS, Washington, D. C. on Federal-State co-operative mapping in West Virginia; and W. A. Hanson, assistant product manager, Joy Mfg. Co., on belt conveyors—key to high production. E. W. Potter, manager, Royalty Smokeless Coal Co., Landisburg, W. Va. presided.

POWER FOR ALUMINUM

The major reasons for aluminum's turn to coal lie in the increasing demand for aluminum, the increased efficiency in coal mining and in coal-based steam generating plants and the dwindling or uncertain availability of other resources for generation of electrical power—a commodity so essential to aluminum production that it is often referred to as one of the raw materials, Mr. Morrow declared.

The new look in coal resulted very largely from the aluminum industry's search for large quantities of low cost power to meet the spiraling demand for this modern metal.

By 1952 it was obvious that hydro-electric power in the United States could no longer be depended upon for the growth requirements of aluminum. Natural gas in the Gulf states was available and the major companies quickly took advantage of the opportunities for firm power and reduced transportation costs to build in Texas, Louisiana and other Gulf states. But, while gas helped fill the gap between 1952 and 1955, it could not be depended upon for the long range plans of the industry. The price of gas shows signs of increase at rates which may not be expected to keep it competitive with coal, Mr. Morrow noted.

To gird itself for the almost unlimited horizons in the market for aluminum, the industry has been forced to conclude that if there is to be expansion there is only one way to turn . . . to coal! Fortunately, coal-based electrical power is ready for the challenge! Mr. Morrow said he believed the coal industry itself is ready.

The location of aluminum reduction plants in the Ohio River Valley provides three major advantages to the industry which are more than enough to offset the lower cost of hydro in other areas, Mr. Morrow explained. First, low cost water transportation is available for the shipment of raw materials and products. Secondly, the Ohio River area is closer to the major markets for aluminum. The Kaiser Aluminum plant in Ravenswood is located within a 500-mile radius of over 70% of the aluminum market. Finally, the favorable price of coal-based electric power with known long-range reserves of coal offer a stability for aluminum production which is not possible either with hydro or natural gas.

Mr. D. A. Rhoades, general manager Kaiser Aluminum has summed it up this way, "The real significance of this combination lies in the fact that the aluminum industry is no longer necessarily dependent upon locations close to large hydro-electric installations which are remote from industrial markets. We are convinced that this development will greatly influence and benefit the domestic aluminum production pattern of the future. We believe it is the turning point for the rapidly expanding aluminum industry."

The real significance of this story of the American aluminum industry's move from hydro to gas to coal is that it no longer must think in terms of plant locations at sites near power sources but remote from market and raw material, Mr. Morrow said. It means that those who in recent years have prophesied that the only future for aluminum rested in the remote Northern areas of Canada, or in faraway foreign lands, were wrong.

TOPOGRAPHIC MAPPING

Although West Virginia was one of the first states to be completely covered by 15-min maps, economic development brought about the need for more detailed and larger maps, Mr. Fitzgerald said. In 1954 some 7½-min maps were started to provide up-to-date maps for the larger, industrial areas. Early in 1956 the state and federal governments appropriated funds for the beginning of a co-operative mapping project that will result in maps having a larger scale, more accuracy and more detail.

The various steps necessary in producing the maps include aerial photography, establishing basic and supplementary control, stereoscopic mapping, field completion of small details, preparation of a copy for reproduction and printing. Each of the operations is completed separately, Mr. Fitzgerald explained, and it takes 3 yr to go through the various steps. The basic accuracy of the maps will be such that with only a few changes they will be useful for many years to come.

BELT CONVEYORS

The entire concept of the use of belt conveyors has changed radically within the last 3 yr, Mr. Hanson said. A belt conveyor formerly consisted of a series of heavy steel intermediate sections with heavy rolls and rigid pans. These conveyors required considerable time and care to be set up. Their use was therefore restricted to semi-permanent installations or in places where quick moves were not essential. Mining plans were based on the use of a great many units to provide the total production, requiring large numbers of conveyors. This frequently led to the decision to employ rail haulage, because of the high first cost of the conveying equipment.

Lately, however, we have seen the increased use of a wide variety of new developments in the conveyor field: rope belts, shuttle belts, self-powered interlocking portables, extensible belts and units employing flexible idlers mounted on a minimum structure. When these

units are combined with high capacity mining machinery they offer so many advantages that they change the entire picture, Mr. Hanson added. In most cases these new units are cheaper than comparable conventional equipment because they employ less structure and use fewer idlers. Since these units are simpler they require far less time to put in operation, thus reducing labor charges and at the same time providing more time for mining operations. Maintenance costs are reduced because there are fewer items and changing worn out equipment takes less time. Mobility also has an effect on cost because the units can be easily moved from place to place.

Continuous haulage has had a pronounced effect upon cost per ton. A recently compiled report shows a decided advantage to be gained from the use of continuous haulage. A comparison was made between shuttle-car and extensible-belt haulage in the same mine. Both systems used the same type of miner and both had approximately the same amount of breakdown time. For shuttle cars the average tons per shift over 40 shifts was 403.9 tons, or 50.5 tons per man shift. During the same period the extensible belt averaged 535.9 tons per shift over 42 shifts, or 76.6 tons per man per shift.

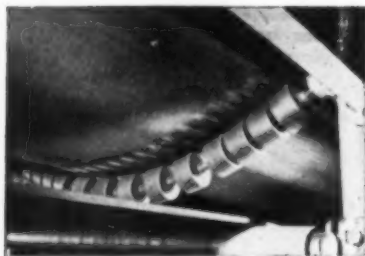
Long rooms are particularly attractive, wherever they are possible, because they reduce development costs, require fewer panel entries and consequently fewer moves. Development work can be speeded up considerably by shortening shuttle car haul or by reducing the number of cars. It is also possible to make combinations of mobile-conveyor sections with self-propelled drives and tails to improve set-up costs and reduce down time due to moves.

In low coal these new units can provide the lowest height section now available. This makes it possible to haul men and materials and still provide proper roof clearances.

On the matter of cost, Mr. Hanson said the new units permit the use of lighter belts. There is an increasing tendency to reduce the cover thickness, and the day must come when little or no covers will be employed. There is already a marked tendency to reduce the duck size. A few years ago, it was considered essential to have 4-ply 42-oz duck on 30-in belts. Today, using synthetic ducks, 32-oz equivalent is working well and there are many places where 3 plies of 32-oz duck are handling run of mine coal on 30-in belts.

Paralleling new developments in conveyor practice is a program of safety. Mr. Hanson said that the increased use of fire-resistant belt will virtually eliminate the possibility of mine fires due to conveyors. Most conveyors are now being equipped with protective devices such as belt slippage switches, which prevent the drive pulleys from turning without moving the belt.

Sequence switches reduce the possibility of discharging coal to an outby conveyor which has been stopped. Pull cord switches and other devices for stopping conveyors along the intermediate run are becoming commonplace.



NEW CONVEYOR BELT IDLER

Handles sticky, abrasive, dusty, or corrosive materials.

Has only two bearings—up out of the dirt.

A 2-bearing, cable suspension idler that resists dust, abrasion, corrosion and material buildup is proving itself superior for bulk handling in many industries.

Called the Limberoller, it has already given 10 times the service life of replaced steel idlers in handling abrasive foundry sands, coal, petroleum coke, potash, copper ores, copper mill tailings, iron ore, wet concrete, triple super phosphate, ammonium sulphate, and sticky fertilizers.

Pressure-molded neoprene or rubber discs on a flexible steel cable conform to load and cushion the belt, help keep belt aligned, and are self-cleaning. The two bearings are up out of the dirt zone; have had no design failures.

Unaffected by most corrosives that damage steel, the new idler is ideal for chemical, sulphur and salt plants; corrosive and high ozone atmospheres. It is more abrasive-resistant than steel and flexes out of the way of abrasive materials.

The Limberoller weighs 2/3 less than a conventional steel idler; is locked by a simple cotter key into special lightweight stands for easy installation and removal. No cover sheets are needed. Two types of stands are available: one that bolts to conventional rigid sections; and a self-supporting type that forms its own easily-erected, portable sections without bolts, by using special stiffening rails.

Because of these unique features, many companies have adopted Limberollers as standard for all belt conveyor operations. Details from Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa. Request Bulletin 11-1.

Personal Notes

James W. McDevitt, preparation manager of Ayrshire Collieries Corp., Indianapolis, Ind., has retired. He served the corporation for 28 yr and was in charge of all Ayrshire preparation plants, the design of which he initiated.

Charles D. Bowling, former West Virginia University mining instructor, has been appointed mine safety supervisor, Operating Dept., Harewood Mine, W. Va., by the Semet-Solvay Div., Allied Chemical & Dye Corp. Mr. Bowling will coordinate the mine's accident prevention program, placing emphasis on supervisory training.

In another Semet-Solvay appointment James L. Shumate, a 1956 graduate of the School of Mines, West Virginia University, was appointed an engineering trainee, Industrial Engineering Dept., Tralee Mine, W. Va. Mr. Shumate was the first to win Semet-Solvay's scholarship to the School of Mines (1952-53).

G. J. Sollings, Mallory, W. Va., has asked to be relieved of his post of vice president, Princess Elkhorn Coal Co. and the Powellton Coal Co. The disclosure was made by James D. Francis, board chairman, who also announced these ex-

ecutive changes: David L. Francis has been elected president of the Powellton Coal Co. and William Crawford has been elected vice president in charge of operations of Princess Elkhorn and Powellton.



George J. Clark

George J. Clark, Pottsville, Pa., has been elected president of Philadelphia & Reading's wholly-owned subsidiary, the Reading Anthracite Co. Mr. Clark will assume the post early in September, succeeding Edward G. Fox who will continue as a director of the parent corporation. Mr. Clark, onetime president of P&R's Shen-Penn Production Co., became P&R's general manager in 1951. In 1954 he was elected vice president.

James J. Merle, former preparation engineer and chemist for Island Creek Coal Co., has been named preparation manager of Ayrshire Collieries Corp., Indianapolis, Ind. He succeeds James W. McDevitt. Mr. Merle was with Island Creek from 1934 to 1940, joined Ayrshire Collieries in 1940.

Paul Boland, Oak Hill, W. Va., has been appointed district inspector of the New River Div., W. Va. State Department of Mines. Mr. Boland, who was employed as foreman for the New River Co. (Summerlee and Oakwood mines), succeeds W. L. Kidwell, retired.

Dr. Robert L. Savage, former assistant supervisor of chemical engineering research at Battelle Memorial Institute, Columbus, Ohio, has been elected vice president in charge of research for the North American Coal Corp.

Five promotions and appointments have been announced by the Gary District mines, U. S. Steel; H. E. Ketter, mechanical engineer has been promoted to district mechanical engineer; Paul E. Wattson, industrial engineer at Lynch, has been transferred to No. 32 mine in



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Here is a light, flexible polyethylene pipe that unrolls like hose, yet possesses super toughness, excellent chemical resistance, and low flow resistance. You can lift a 200-foot roll of 2-inch pipe to your shoulder and carry it anywhere—it weighs only 86 pounds.

Few joints are necessary since NATIONAL Plastic Pipe will turn bends, go over or under obstructions. It's easy to cut, and the fittings, when needed, are of the insert type, quickly secured with stainless steel clamps. No adhesive is necessary. Ells, tees, couplings, reducers and valves are available to suit any layout.

USS NATIONAL Plastic Pipe resists attack by a wide variety of acids, alkalis, salts and many other chemicals. And, of course, it won't rust or corrode. Rough handling won't crack it, even at low temperatures. In fact, it remains tough and flexible over its entire working range from minus 90° F. to plus 120° F.

Manufactured from only the purest 100% "on grade" polyethylene raw material, NATIONAL Plastic Pipe is available in sizes from 1/2 inch to 6 inches in diameter, in a variety of wall thicknesses. Find out how NATIONAL Polyethylene Plastic Pipe can be applied to your mine drainage system by writing for full information to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

* Trademark



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

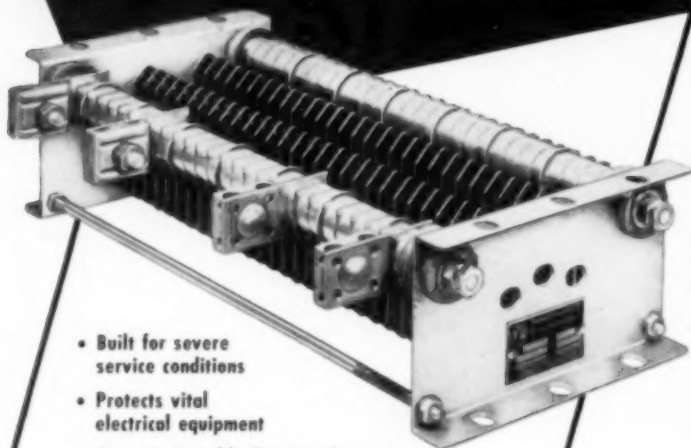


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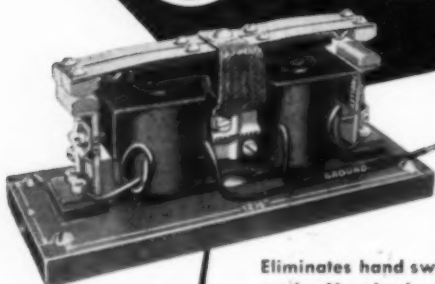
- Built for severe service conditions
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These rugged nonbreakable units have proved their merit in all kinds of service for many years. Made of steel and mica, plus P-G unique and exclusive grid design, P-G Resistors are capable of protecting your most vital electrical equipment, even where service requirements are severe.

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AUTOMATIC Transfer Switch



Single or double
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Eliminates hand switches—entirely automatic. No shocks or burns to operator while changing from trolley to reel. Simple, safe, efficient, easy to install, can be mounted anywhere. For 250 to 600-volt service. Complete with cover.



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Personal Notes (Continued)

been promoted to senior project engineer; Charles Yurick, shift foreman at Corbin Washer, Lynch, Ky., has been transferred as preparation engineer to the Alpheus coal cleaning plant, Gary; William C. Banner, senior draftsman has been promoted to mechanical engineer.

J. M. Cook has resigned his post as a member of the W. Va. State Dept. of Mines Safety Commission and joined the Lillybrook Coal Co. as chief electrician of the company's Affinity Slope mine, W. Va. Mr. Cook succeeds Earl Waters, who has been transferred to Lillybrook No. 3.

Courtland T. Dahlin has resigned as general superintendent of mines, Lillybrook Coal Co. and Amigo Smokeless Coal Co. He is succeeded by Arthur J. Pugh, former division superintendent for Lillybrook. Mr. Dahlin resigned his post at Lillybrook to become general superintendent at Princess Elkhorn Coal Co., David, Ky.

Obituaries

Ford Edward Kittle, 50, of Buckhannon, W. Va., and superintendent of the S. M. Miller Coal Co. mine at Turkey Run, was killed July 5 in a mine accident.

Clayton C. Dovey, Sr., founder and chairman of the board of Cambria Fuel Co., Johnstown, Pa., died June 30. He was 76. Mr. Dovey worked in civil and mining engineering and mine management until he organized the Cambria company in 1920.

Association Activities

Wilfred S. Webster, executive vice president and general manager of Walter Bledsoe & Co., Terre Haute, Ind., was elected president of the American Coal Sales Association June 30 at the association's annual convention in White Sulphur Springs, W. Va. He succeeds S. L. Jewell, Southern Coal Co., Inc., Chicago, Ill. Other officers: vice presidents, H. P. Junod, Pickands Mather & Co.; C. R. Mabley, Jr., Island Creek Coal Sales Co.; and J. R. Maust, Maust Coal & Coke Corp. D. H. Swanson, Sunnyhill Coal Sales Co., was elected secretary-treasurer.

R. S. James, U. S. Bureau of Mines, Pittsburgh, Pa., has been elected president of the Central Advisory Council of the Mining Electro-Mechanical Maintenance Association. Mr. James was elected during the association's annual election June 15, 1956 in Pittsburgh, Pa. Vice presidents are M. J. Mechling, Valley Camp Coal Co., St. Clairsville, Ohio; J. H. Flemming, Joy Mfg. Co., Franklin, Pa.; and C. S. Conrad, Consolidation Coal Co., Monongah, W. Va. A. E. Molinski, supervisor of maintenance, Johnstown Div., Bethlehem Mines Corp., Johnstown, Pa., was reelected secretary-treasurer.



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It's no bigger than the palm of your hand, but this O-B Rail Clamp carries 400 amps all day long without overheating—even on scale and rust-covered rail!

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Compton Budget Model 28 Coal Auger

The latest of the famous, efficient Compton Coal Augers, but already known for its record setting performance figures. Only 28 feet long this Compton Auger, with a crew of just 3 men will auger and load up to 65 tons of coal per hour. Compact and lightweight, it is right at home even in cramped quarters and does not require a great deal of costly advance preparation.

GENERAL SPECIFICATIONS — MODEL 28

Length: 28 feet
Weight: Approx. 25 tons
Carries twelve 12½ ft. auger sections
Required pit width: 30 ft. min.
Power: 175 hp Diesel engine
Hydraulic Frame Jack Lift: 54 inch
Auger Diameter: 44" to 28"
Drills coal within 4¾" of the bottom
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Only Compton Augers are equipped with the job-proven, non-clogging Compton Lump Recovery Head. Their built-in spider bearing assembly assures straighter drilling with less frictional drag.

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News Briefs (Continued)

in the national contest, Germantown Colliery compiled 360,900 man hours with 31 disabling injuries. Total lost time was 390 days for a low injury severity rate of 1.081.

Gary L. Draper, Hiawatha, Utah, has been named the recipient of the 1956 United States Fuel Co. (Salt Lake City) scholarship.

Former pupils of Lucien Denoel, a lecturer on coal mining at the University of Liege, Belgium, have created the Lucien Denoel prize for the author of a



"ENGINEER OF THE YEAR" is the title bestowed on William H. Lesser, Scranton, Pa., by the Northeast Chapter of the Pennsylvania Society of Professional Engineers. Teacher, designer and prize-winning technical writer, Mr. Lesser is currently a consulting mechanical engineer for the anthracite flood prevention project being conducted by the U. S. Bureau of Mines. For more than 20 yr he was associated with Pierce Management, Inc., Scranton, as mechanical and electrical engineer.

thesis dealing with coal mining ventilation, mine draining methods, the use of explosives in the mine and preparation. A prize of 60,000 Belgian francs (approximately \$1,200) will be awarded for the first time in 1957. The thesis must show a "truly scientific approach and considerable originality, and must not have been dealt with in a previous publication." The examining board will accept articles in triplicate written in French, Dutch, German and English, and not more than 10,000 words. Address: Jury du Prix Lucien DENOEL, c/o A.I. Lg., 22, rue Forguer, Liege, Belgium. Entries must be received by July 1, 1957.

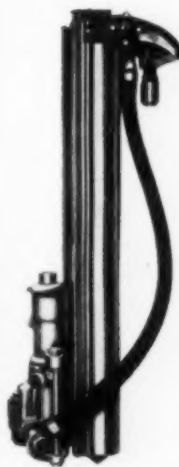
Captained by Kenneth Dinger, the Ringgold Cleaning Plant, Freebrook



28" FEED



46" FEED



64" FEED



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*All models available in either SAV-A-CHANGE
or Socket Type Chuck*

● The new CLEVELAND S20 VAC-NU-MATIC dust collecting stopper is available in 3 feed lengths to suit any working height down to a 26" seam. It will produce a 30" hole in a 26" seam without using coupled steel. The 28" feed weighs 69 lbs. complete. Any model may be used either hand held or jumbo mounted. VAC-NU-MATIC bits are fast and free cutting and eliminate all stuck steels. Dust collection is positive even in wet top. Chucks may be replaced without dismantling the machine, using only a pair of snap-ring pliers. Cuttings are removed at the chuck housing and do not pass through the machine. Write for bulletin RD32 or let us demonstrate in your own mine.

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PORTABLE AIR COMPRESSORS



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***you can't check air pressure
by kicking a tire***

... And you can't check bolt tension by "wrist feel."



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Your *Snap-on* man will be glad to give you a valuable free book listing torque specifications covering all makes of cars, trucks, tractors and industrial engines. Ask for it along with new *Snap-on* tool catalog or write direct to *Snap-on*.

That's why top mechanics depend on the *Snap-on** torquemeter to take the gamble out of every operation where bolt tension is specified, like take-up on main bearings, cylinder heads, connecting rods and manifold nuts.

And there's nothing to it. Set the adjustable dial at the bolt tension specified by the manufacturer and tighten until the easy-to-read pointer reaches zero or the bulb on the flash model lights.

Snap-on builds 39 torquemeter models ranging in torque capacities of from 0-30 in. lb to 0-4000 ft lb and 0-35 c. kgs. to 0-280 m. kgs. Let a *Snap-on* man show you its advantages by demonstrating a torquemeter on your job. He will help you choose the right model for your specific needs.

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News Briefs (Continued)

Corp., Timblin, Pa., earned a 100% rating at the Philipsburg, Pa. Moshannon-North Central Safety Association's 10th Annual First-Aid Meet in June. Northwestern Mining & Exchange Co.'s Kramer Mine, Stump Creek, Pa., was second with a rating of 99.6%. It was captained by Stanley Verona. Third and fourth places were won by the Elliott Coal Mining Co. (99.001%) and the Cambria Clearfield Mining Co. (99%).

A new market for coal is being developed in the processing of taconite for steel. Taconite output is expected to hit 40 million tons by 1980, a rate requiring 1.5 million tons of coal each year in the form of electricity.



COAL MEN ON THE JOB . . .

KEY MEN at Westmoreland Coal Co., Madison, W. Va., are Lawrence Sutton (left), superintendent Hampton No. 3 mine, and C. J. Robinson, general superintendent, who are discussing mining plans in the No. 3 mine office.



FIATT, ILL., TRUAX-TRAEER COAL CO.—Carl Bowlin, plt foreman.

Invulnerable

to cuts and ruptures in the tread area!



Here's why... exclusive

SAFETY *STEEL* SHIELD*

Here, between tread and cord body, are thousands of cords of flexible steel. This Safety Shield is invulnerable to cuts and ruptures for original tread life *and* extra recap life!

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You are looking at a new kind of on-and-off-the-road truck tire. It is so *immune* to road hazards it runs over razor-sharp axblades without losing a pound of air. It has the deepest tread U. S. Royal has ever built into this type of tire. It is so *versatile* it outperforms on any wheel—gives greater stability on front wheels, increased traction on drive wheels, extra recaps on trailing wheels.

For dump trucks, transit mixers, log haulers... on any rig exposed to heavy impacts, tire-killing terrain. You'll enjoy fewer tire failures, less down-time expense, greater service dependability.

In sizes through 11.00. See your U. S. Royal Dealer... or write Truck Tire Department. You can specify "Super Fleetmaster" on your new equipment.



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NEW MANUAL

on heavy media SPIRAL SEPARATORS AND DENSIFIERS



Experimentation on use of the Akins Spiral Classifier in making a sink and float separation was first started in 1938. In 1944 the first commercial 78" Akins Separator was placed in successful operation by one of the large iron mining companies. Since then there have been many developments and refinements, mechanically and metallurgically, in the Akins Separator and the HMS process. This new manual is a complete presentation of these developments and includes the latest data on heavy media spiral separators and densifiers...

- development of spiral HMS separators
- discussion of metallurgical and mechanical operation of spiral separators
- handling of middlings
- how the Akins makes a 3-product separation with one medium circuit
- operating data showing actual results
- purpose of the densifier and how it works
- flowsheets
- capacities and engineering data on Akins Separators and Densifiers
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PILOT PLANT TESTING SERVICE AVAILABLE

CIW has a 12" Akins Separator at the Colorado School of Mines Research Foundation which is available for conducting pilot tests.

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News Briefs (Continued)

Bituminous Coal Research is exploring the use of the electrostatic principle in cleaning fine coal sizes. BCR says it has begun the study with the cooperation of the Quaker Oats Co., which uses equipment incorporating the electrostatic principle to clean corn, wheat and mineral products. In operation, the equipment creates a high-voltage (20,000) field in which impurities pick up an electrostatic charge. This separates them from pure objects, i.e. coal, passing through. BCR says its first objective is to compare the method with conventional fine-coal cleaning—in particular, cost of equipment, cost of operation, and efficiency.

Glen Alden Corp., Wilkes-Barre, Pa., has begun construction of a \$1 million all-steel anthracite breaker near Hazleton, Pa. Francis O. Case, Glen Alden's president says the breaker is designed for an annual capacity of 250,000 tons.

Latest available statistics disclose that electric utility companies have used 10 million tons or more each month since October, 1954, a period of 18 months. Total consumption for the period was more than 218 million tons.

EQUIPMENT APPROVALS

Eight approvals of permissible equipment were issued by the U. S. Bureau of Mines during June.

Consolidation Coal Co.—Rebuilt Joy 118U-11APE loader; two motors, one 50 hp, one 4 hp, 250 v, DC. Approval 2-1152, June 7.

Goodman Mfg. Co.—Type 584-10 shuttle car; three motors, two 15 hp, one 20 hp, 230 v, DC. Approval 2-1153, June 11.

Goodman Mfg. Co.—Type 584-11 shuttle car; three motors, two 15 hp, one 20 hp, 230 v, DC. Approval 2-1154, June 11.

Joy Mfg. Co.—Type 3JCM-5H continuous miner; seven motors, two 100 hp, one 10 hp, four 7½ hp, 440 v, 3 phase, 60 cycles, AC. Approval 2-1155A, June 14.

Clarkson Mfg. Co.—Clarkson Marietta continuous miner; three motors, each 50 hp, 500 v, 3 phase, 50 cycles, AC. Approval 2-1157A, June 19.

Joy Mfg. Co.—Type 2BT-1F twin-bore miner; four motors, two 100 hp, two 15 hp, 500 v, DC. Approval 2-1065A, June 21. (Approval 2-1065 covering 250-v miners of this type was issued May 16, 1955.)

The Long Co.—Type PT115 piggy-back conveyor; one motor, 5 hp, 230 v, DC. Approval 2-1158, June 27.



"Easy as filling a coffee bag," say men who prepare supply of Akremite.



Simple and safe to store, Akremite can be mixed right at the mine location.

"How We Cut Blasting Costs 50%, Increased Output 20%, with New Akremite Process"

Spencer prilled Ammonium Nitrate is base for new simple, safe, low-cost explosive

"We've found the new Akremite Blasting Process, now in use at our Cheshire, Ohio, operations, to be the ideal explosive for strip mining," reports F. H. Howe, Superintendent of Ohio River Collieries. "Because the ingredients are cheaper and the mixing process so much simpler, we have cut explosive costs 50% with Akremite. At the same time, better fragmentation produced by Akremite lets us move 20% more yards per month.

"The terrain in which we work is unusually difficult, but because Akremite is so safe and easy to handle, we still come out ahead."

☆☆☆

Akremite, the simple but revolu-

tionary new explosive, is named after its inventor, R. I. Akre, superintendent of drilling at Maumee Collieries Co., Terre Haute, Ind. Akre uses prilled Ammonium Nitrate, produced by Spencer Chemical Company, as the base for his new explosive.

By itself, ammonium nitrate is not an explosive. But Akre found that if he mixed it with carbon black, packed it in a polyethylene bag, confined it in a drill hole and detonated it with a high gelatin dynamite and primacord, it produced a tremendous explosion.

Recently, Southern Research Institute at Birmingham put Akre-

mite through a series of safety tests. They fired bullets into bags of freshly made Akremite. And they conducted the regular pendulum-friction and modified propagation-through-air tests.

Not a single explosion, fire or crackling resulted from any of these tests. Akremite with Spencer prilled Ammonium Nitrate is not only cheaper and better, but many mines report it is the safest strip mine explosive they have ever used.

(NOTE: Spencer Chemical Co. will be happy to provide you with further information about the Akremite Method as discussed by Mr. Howe.)

SPENCER CHEMICAL COMPANY

610 Dwight Building • Kansas City 5, Mo. • Baltimore 1-6600



CLEANER MINE CARS... MORE PAYLOAD PER TRIP

After a months use, this Automatic Electric Car Cleaner not only increased the payload per mine car, by reducing the tare weight 200 pounds per car, but also increased the flow of coal through the tippie by approximately 2900 tons in a large West Virginia mine.

This device is designed to free wet coal clinging to corners and bottoms of cars. It also speeds unloading by making all of the coal flow freely.

Operation—Coal is loosened and freed from the car by hammers striking against the bottom of the mine car after it is turned upside down in the rotary dump. As the dump turns the car to the inverted position, electrical contacts are made to start the motor driving the cleaner. Coal is loosened by impact of steel hammers. These are moved up and down by pivoted arms operated by cams on the drive shaft. Each cam is mounted in a different position so that each hammer strikes the car at a different time. The cam shaft revolves once per second.

This device permits fast, easy car cleaning, yet is of simple construction.

Write for further information.



VALLEY MACHINE & ELECTRIC SHOP, Inc.

Box 169
FAIRMOUNT, W. VA.

Books for Coal Men

A Study of Problems Encountered in Multiple-Seam Coal Mining in the Eastern United States, by D. T. Stemple, is a detailed study of the problems met in multiple-seam mining. The subject is analyzed under the following classifications: effects of a superjacent seam being mined first; effects of a subjacent seam being mined first; effects of simultaneous mining of contiguous seams; effects produced by mining more than two vertically adjacent seams; and leaving coal in place for support. Officials from 45 different mining and land companies were consulted and 61 examples of multiple-seam mining were made available for study. Tables accompanying the work contain excellent data on conditions, effects and extent of the difficulties caused by and encountered in multiple-seam mining. 64 pp plus tables. 6x9-in; paper. \$1. Engineering Experiment Station Series No. 107, Virginia Polytechnic Institute, Blacksburg, Va.

Motor Grader Operation

Basic Grading is a fundamental manual on the operation of a motor grader. The basic blade positions are explained and illustrated with sketches and diagrams. Basic maintenance procedures also are

included. 30 pp. 5½x8¼-in; paper. Caterpillar Tractor Co., Peoria, Ill.

Safety

Supervisors Safety Manual, written by staff engineers of the National Safety Council, provides a guide for foremen in all phases of industrial safety. It may be used for group training or as a reference work. 354 pp. \$3.25 for Council members, \$6.50 for non-members. National Safety Council, 425 N. Michigan Ave., Chicago, Ill.

Safety Management, by R. H. Simonds and J. V. Grimaldi. A guide to effective safety management in industry. It is designed as a tool for safety directors and safety engineers and others concerned with safety, and relates safety to other aspects of management. 567 pp. \$7.80. Richard D. Irwin, Inc., 1818 Ridge Road, Homewood, Ill.

European Coal Industry

The Coal Industry in Europe is a study by The Organization for European Economic Co-operation covering the trend of the industry in 1955, the factors likely to affect demand in 1956 together with the outlook for future production. 61 pp. plus tables. \$1. OEEC Publications Office, 2000 P St., Washington 6, D. C.

NEMA Standards

Mining Belt Conveyors is an up-to-date edition of Bulletin MB 1-1954 and includes new standards and definitions set up by NEMA. It provides information on construction, rating and nomenclature of mining belt conveyors. Pub. No. MB1-1956. 34 pp. 8½x11½-in; paper. \$1.50. National Electrical Manufacturers Assoc., 155 E. 44th St., New York 17, N. Y.

Mining and Industrial Electric Locomotives is the latest edition on standards for mining and industrial electrical locomotives. Pub. No. MI 1-1956. 48 pp. 8½x11½-in; paper. \$1.75. National Electrical Manufacturers Assoc., 155 E. 44th St., New York 17, N. Y.

MEETINGS

Central Advisory Council, The Mining Electro-Mechanical Maintenance Association; 4th Annual Meeting, Oct. 6, Mountain View Hotel, Greensburg, Pa.

ASME-ASLE Lubrication Conference; Oct. 8-10, Chalfonte-Haddon Hall, Atlantic City, N. J.

Anthracite Conference; Oct. 18-19, College of Mineral Industries, Pennsylvania State University, University Park, Pa.

Central Appalachian Section, AIME, and W. Va. Coal Mining Institute; Nov. 2-3, Greenbrier Hotel, White Sulphur Springs, W. Va.

ARMSTRONG-BRAY GEAR and WHEEL PULLERS



Quickly and easily pull gears, wheels, pulleys and bearings off of shafts without damage or breakage.

Improved designs make them easy to set up and safe in use — the harder the pull the tighter the grip.

12 types, 40 sizes—2-arm, 3-arm, standard and special STEELGRIP Pullers with drop forged arms and heat treated screws as well as CHAINGRIP Universal Pullers that reach to considerable distances from end of shaft.

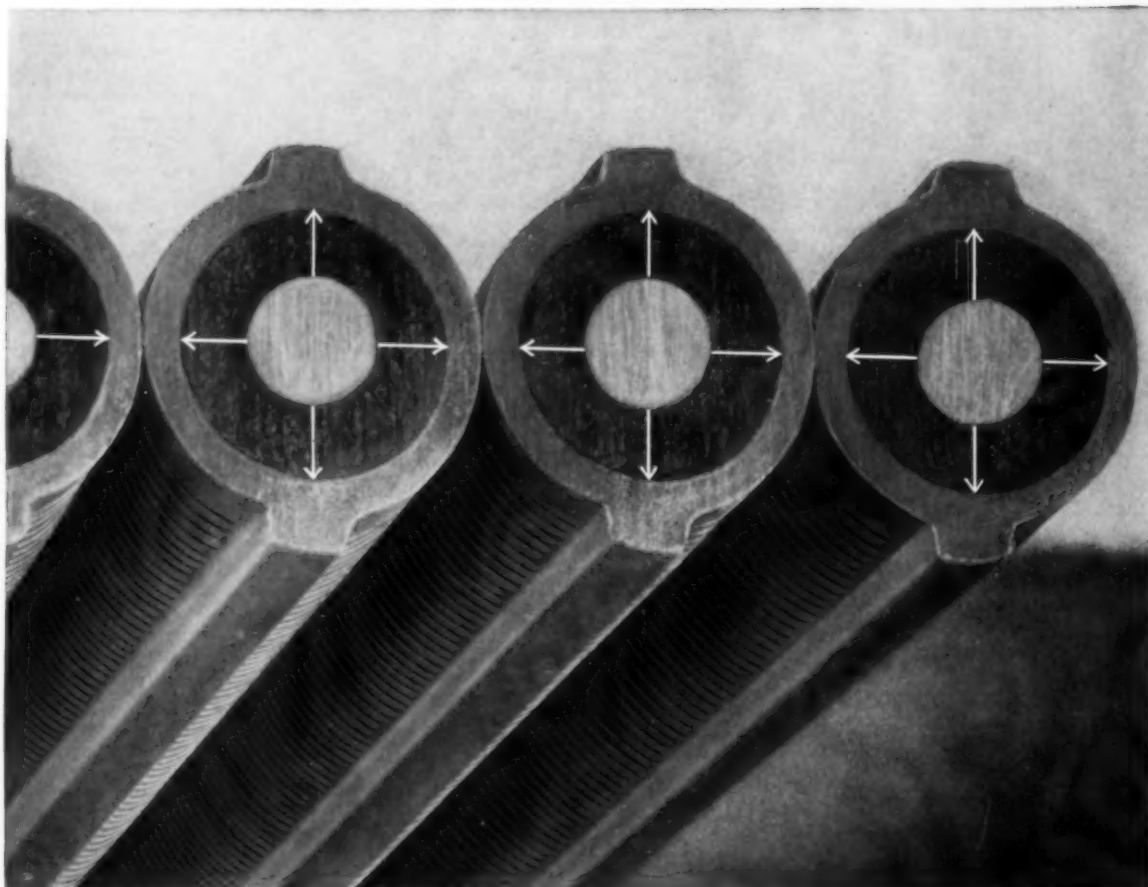
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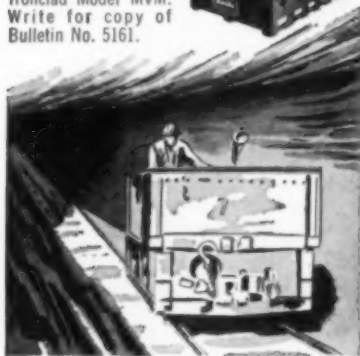
EXIDE-IRONCLAD BATTERIES

For all mining applications



Power tubes expand without shedding — preserve battery life

BATTERY FOR MINE LOCOMOTIVE, Exide-Ironclad Model MVM. Write for copy of Bulletin No. 5161.



Every time you discharge a storage battery, the active material on the positive plates expands. But the plate grids don't expand. This is basic.

On most batteries, the expanding active material tends to shear off from the nonexpanding grid every time the action takes place. But this can't happen in the Exide-Ironclad Battery. The reason is simple.

Active material is formed concentrically around the spinelike grid and held inside the plastic tubes. Expansion is predominantly in an outward direction—hence no shearing. Active material remains firmly locked to the underlying grid structure. And the flexible plastic tubes yield and take up as needed.

This extra protection against shedding of active material is only one of the many reasons for the long life of Exide-Ironclad Batteries. When you order heavy duty batteries, or the equipment requiring them, be sure to specify Exide-Ironclad. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

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plastic pipe...so**

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THE STRIPE!**



THERE ARE many brands of plastic pipe ... some good, some not. They all look alike ... except CARLON[®], the best of 'em all. It's THE PIPE WITH THE STRIPE ... guaranteed for life against rot, rust and electrolytic corrosion! Price is competitive, too.

Whether you use Carlson plastic pipe to carry off corrosive mine waters, or to convey water wherever you want it ... above ground or below ... it will never fail you as metal or inferior plastic pipe may. SO LOOK FOR THE STRIPE!

Carlson plastic pipe not only performs better and lasts lots longer ... it's far less expensive, too. Less in first cost, less in handling cost, less in installation cost ... and, of course, much less in lifetime cost!

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WORLD'S LARGEST MANUFACTURER OF PLASTIC PIPE

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We are interested in Carlson plastic pipe for coal mines. Please send more information.

Name _____

Company _____

City and State _____

Among the Manufacturers

Dorr-Oliver, Inc., Stamford, Conn., has announced a \$900,000 expansion program for its manufacturing plant in Hazleton, Pa. The company says the money will be used to enlarge fabricating facilities and thus enable Dorr-Oliver to produce its own structural parts, a job it has been sub-contracting to outside companies. Two new buildings totaling 30,000 sq ft will boost the Hazleton plant floor space to 125,000 sq ft. The new facilities are expected to be in operation by the end of 1957.

An expansion program that is expected to double engineering facilities is underway at the Wilmot Engineering Co., White Haven, Pa. The company disclosed that all plans have been drawn and that construction of plant additions is in progress. A new heavy plate shop is nearing completion. Wilmot also announces that it is establishing a sales organization which will give it direct representation in national and foreign markets.

Fuller Co., Catasauqua, Pa., has acquired all the assets of Lehigh Fan & Blower Co., Allentown, Pa. The transfer includes trade-marks, trade-names and the goodwill of Lehigh, which will operate as the Lehigh Fan & Blower Div., Fuller Co. Fuller, itself, is a wholly-owned subsidiary of General American Transportation Corp., Chicago, Ill.

General Electric is changing the name of its Carboloy Dept. to the Metallurgical Products Dept. to reflect the company's emphasis on specialty metals development and manufacturing. Departmental headquarters will remain in Detroit, GE says. It was this department that last month disclosed it was successfully operating a pilot facility making diamonds.

National Carbon Co., a division of Union Carbide & Carbon Corp., will dedicate its new Parma, Ohio, research laboratory, September 18. The laboratory is designed primarily for basic research in chemical and solid state physics. Constructed at a "multi-million dollar" cost, the laboratory brings to seven the number of research centers being operated by Union Carbide & Carbon divisions. Last year the company spent \$43 million on research.

The Milwaukee branch of Thor Power Tool Co., Aurora, Ill., is being moved to a new building in Milwaukee. The new structure gives the company twice the space in which to expand repair and service facilities. Thor manufactures portable air and electric power tools.

Union Wire Rope Corp. is opening a new warehouse in Minneapolis. L. E. Anderson will be district manager.

Black & Decker Mfg. Co., Towson 4, Md., is forming a new sales depart-

ment, the Service Sales Div. It will begin operating October 1 when John P. Spain, Pacific coast regional manager, will assume the post of service sales manager.

A Silver Battery Div. is being formed by the Exide Industrial Div., The Electric Storage Battery Co., Philadelphia, Pa. J. J. Sullivan will manage the new division, which will manufacture silver-zinc batteries at Exide's Philadelphia plant.

The Jeffrey Mfg. Co., Columbus, Ohio, announces these personnel changes: William K. Myers replaces R. W. Sweitzer as district manager of the New York office; Tom Fear, Jr., replaces Harley Lee as district manager of the St. Louis office, where Mr. Lee will continue in an advisory capacity; William T. Davis, formerly of the Houston office, moves to the company's western sales office in San Francisco as application engineer; William A. Lewis is appointed sales engineer for the Houston district office; Ralph Bolton is named sales engineer of the Birmingham district office; and James A. Frazier is assigned to the Industrial Sales Div., Beckley, W. Va. In other changes Jeffrey has replaced C. O. McFadden, manager of the Columbus district with John Chrystal, manager of original equipment sales. Mr. McFadden continues as an advisor. Mr. Chrystal is succeeded by A. T. Loew, who, in turn, is succeeded as office manager of the merchandise sales division by Dick Ross.

C. A. Peters has joined the Daniels Co., Contractors, Inc., Indiana, Pa., as a preparation engineer. Mr. Peters was formerly preparation engineer for the Norman Coal Corp., Mullen, W. Va. He will serve the West Virginia, Virginia and Kentucky coal fields.

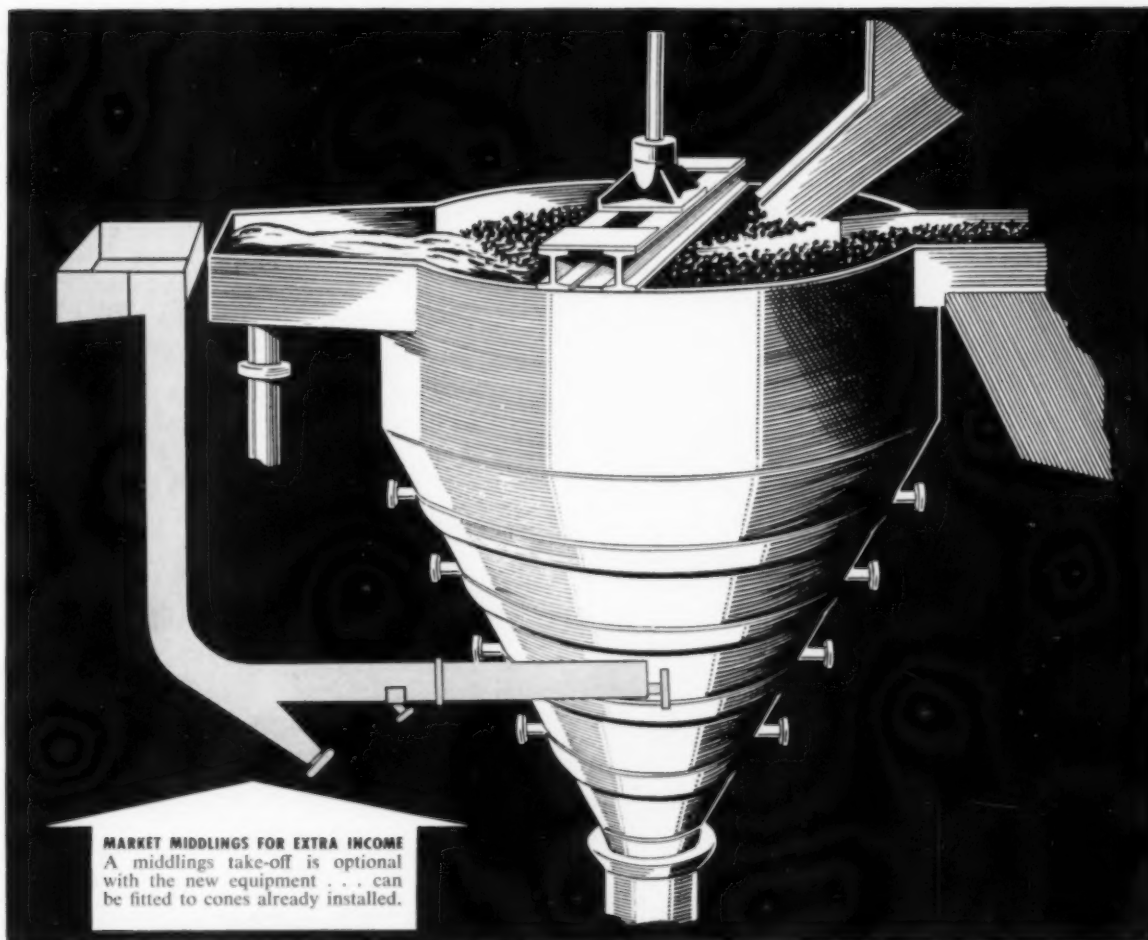
Russell G. Creviston, Crane Co., executive, has retired after 27 yr with the company's general office in Chicago, Ill. Mr. Creviston joined Crane as manager of sales promotion, later moved to the job of public relations director (1943).

John R. Jones has been appointed sales manager of the Pioneer Rubber Co., New York, N.Y. Mr. Jones was formerly field sales manager of the Sundries Div., B. F. Goodrich Co., Akron, Ohio.

Dwight H. Thayer, advertising manager, and John R. Woods, Pittsburgh sales representative, have been made sales managers of Rome Cable Corp., Rome, N.Y.

Russell W. Chaffin has been appointed general sales manager, Industrial Rubber Div., Thermoid Co., Trenton, N.J. Mr. Chaffin was sales manager of the company's Western Division before the appointment. In another announcement Thermoid disclosed that J. Wilbur Huff

(Continued p 162)



MARKET MIDDINGS FOR EXTRA INCOME
A middlings take-off is optional with the new equipment . . . can be fitted to cones already installed.

LET US HELP SOLVE YOUR COAL-CLEANING PROBLEMS

Regardless of the size of your operation, the Chance Sand Flotation Process offers the most economical, dependable and lasting solution to your coal-cleaning problems. Chance Cones now used in all major coal producing areas throughout the world offer these important features:

HIGH SEPARATING EFFICIENCY

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- . . . Washing gravity not affected by fluctuating rates of feed

WIDE FLEXIBILITY

- . . . Coal handled at gravities from 1.35 to 1.65 with size from $\frac{1}{8}$ in. to 10 in.
- . . . One man can change washing gravity in 5 minutes

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- . . . Heavy, well-built equipment assures trouble-free performance
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Shippers save time and dollars ...with fast movement of coal by Central

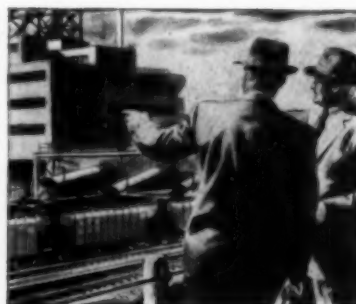
THE NEW YORK CENTRAL docks at Toledo—largest and best equipped coal and ore docks on the Great Lakes—provide equipment for carriers to unload at rate of around 2,000 gross tons per hour. Speedy unloading of ore and faster loading of coal enable quicker dispatch of vessels. New York Central's dock facilities include thawing devices that speed early spring and late fall shipments ... floodlights for round-the-clock loading ... ship-to-shore radio to expedite shipping.



The great fleet of New York Central's heavy-duty coal cars give shippers extra assurance of prompt pick-up from mines in the rich coal fields of Illinois, Indiana, Kentucky, Maryland, Ohio, Pennsylvania, Virginia and West Virginia. New York Central service in handling and hauling shipments of coal is dependable.



New markets for coal in Central's territory include an expanding chemical industry ... plus billions in new steam power plants being built by private electric companies. And that's besides the majority of America's steel mills, factories, public buildings and coal-heated homes ... all located in the Central area.



He knows what's new in coal! Your New York Central Coal Traffic Representative can save you time and money on coal shipments ... aid in developing new coal properties ... or locate special types of coal you may need. His help and coal experience are at your call. It is part of New York Central's Service.

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Route of the "EARLY BIRDS"—the one day faster freight service

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Tractor Dozer's 33° bowl tilt helps speed ledge cleanup at Consolidated Copper's open pit near Ely, Nevada.

Before you buy any dozer...

Check Michigan Tractor Dozer's 27 mph speed, power-tilting bowl, full-time four-wheel traction

If you're in the market for any kind of dozer, be sure to check the new MICHIGAN Tractor Dozer before you buy. This job-proved unit dozes 2¾ cubic yards per pass. Its turbo-charged diesel engine develops 165 hp, with maximum rimpull of 28,000 lbs.—plenty for heavy-dozing, land-clearing, or push-loading. At 27 mph, it runs rings around any dozer on the market!

Full traction while turning. All four wheels of the Tractor Dozer are *always* driving, except when you declutch rear axle for highway travel. Rear-wheel steer eliminates unnecessary tire wear—you don't brake or drag inside wheels on turns. If one wheel begins to slip, a locking differential automatically applies power to wheel with firmest footing.

High flotation tires, oscillating axle. Big low pressure tires give the Tractor Dozer excellent ground contact in wet, dry, or sandy footing. You can cross rail-road tracks or travel along ties or road bed; you can climb curbs and drive safely on any kind of road surface. On uneven terrain, the steering-wheel axle oscillates to keep both rear wheels in firm contact with the ground. With 14½ inches of

ground clearance, it's practically impossible to get "hung up."

Power-shifting, 300% torque multiplication. Clark's power-shift transmission eliminates the conventional engine clutch and foot pedal—the most notorious cause of excessive maintenance and operator fatigue. With two fingertip levers on the steering column, operator can instantly shift between High-Low and Forward-Reverse—even when moving in either direction.

The 3-to-1 Clark torque converter gives a steady power flow, regardless of speed. As load gets heavier, torque output automatically increases up to 300% at stall speed—gives the extra torque to plow through the roughest spots. You can't stall the engine, and there's no clutch to slip.

Power-tilting bowl. Powerful double-acting hydraulic cylinder tilts bowl back and forth through 33 degree arc. You can change angle of bowl from "dig" to "float" as you work... move cutting edge back and forth to uproot stumps and boulders. Two 6-inch lift cylinders give tremendous lifting power and down-pressure—cutting edge raises from 24¼

inches below ground level to 43¾ inches above.

See Tractor Dozer in action—on your job. Write us to arrange a demonstration. You pick the work... then time cycles, measure output, compare price per yard of dozing capacity (don't forget MICHIGAN's f.o.b. price includes power-shift transmission, torque converter, planetary-wheel axles, and power-tilt blade... you don't have to pay for "extras" to get top efficiency). Or, if you'd like more details, before taking the time to watch a demonstration, ask us to show you a 20-minute color movie of the Tractor Dozer. No obligation, of course.

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2473 Pipestone Road
Benton Harbor 38, Michigan

Michigan is a registered trade mark of

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EQUIPMENT

OSMOSE

TREATED

TIES AND TIMBERS

CAN SAVE YOU

25¢ per ton

Here's how! 30% to 50% of your supply bill is for TIMBER and TIMBERS can cut this expenditure to one-tenth by using Osmose scientifically-treated Mine Ties and Timbers. Osmose simply because they LAST 3 to 5 TIMES LONGER. Mine ties and timbers don't just "rot" or "decay" in the sense that these two popular words might convey. Actually, they are "eaten up" by microscopic organisms that feed on the wood fibers. Osmose is poison to these micro-organisms, which die or look elsewhere for their food.

Proof of the fact that this 25¢ per ton saving is possible can be yours by directing an enquiry to any of a long list of famous mines that SAVE thousands of dollars per year with Osmose Treated Ties or Timbers. For instance, in 1954 the Island Creek Coal Co. said: "We have been using Osmose Timbers in our mines since 1942 . . . We are pleased with the results."

You'll be more than "well pleased" when Osmose Treated Ties or Timbers start saving YOU up to 25¢ per ton. Let us send you complete details NOW.

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illustrated booklet,
gives you all the
facts. Write for it.

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Representatives in: Pittsburgh, Denver, Birmingham, Ala., Charleston, W. Va. and Harlan, Ky.
"Leading Manufacturers of Wood Treating Specialties"

Manufacturers (Continued)

has been appointed technical manager of the Rubber Division. Mr. Huff replaces Mr. John A. Muller who has been named director of research and development.

J. E. Glass, Jr., has been appointed sales representative of Newcomer (Latrobe, Pa.) mining tools in southern West Virginia and eastern Kentucky. Mr. Glass was formerly with the Truax-Traer Coal Co. His headquarters will be in Beckley, W. Va.

Ronald Jenkins has been given the post of assistant advertising manager, Simplicity Engineering Co., Durand, Mich. Mr. Jenkins will be responsible for coordinating advertising and sales promotion.

Contractors Equipment and Truck Co., Inc., 780 E. 3rd St., Lexington, Ky., has been named Kentucky distributor by LeTourneau-Westinghouse Co., Peoria, Ill.

Willard J. Hannon has been appointed a sales representative by the Leschen Wire Rope Div., H. K. Porter Co., Inc., St. Louis, Mo. Mr. Hannon will sell Leschen products in western Illinois; St. Louis, Mo. and much of Missouri.

Dr. L. E. Lighton, vice president and director of research, The Electric Storage Battery Co., Philadelphia, Pa., has retired. Capt. Clifton G. Grimes, U. S. Navy (ret.), will succeed Dr. Lighton as director of research.

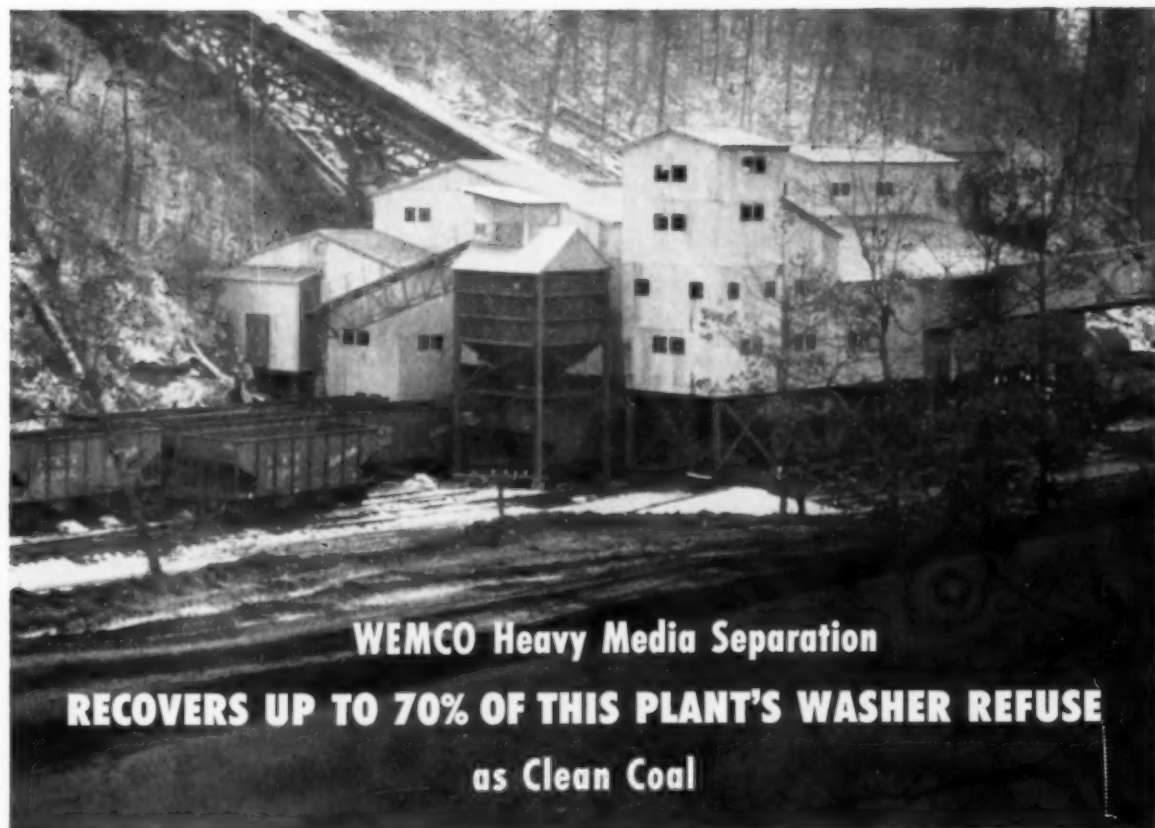
Two new distributors of Lima shovels, cranes, draglines and pull shovels have been announced by Baldwin-Lima-Hamilton Corp., Lima, Ohio. Emmett C. Watson Co., Inc., Louisville, Ky. will cover Kentucky, except in Boone, Kenton, Campbell, McCreary, Whitley and Bell counties. Evans Engine & Equipment Co., Seattle, Wash., will cover the western half of Washington and all of Alaska.

Crane Co. has announced appointments to three sales posts: Thomas D. Kelly has been appointed manager of the company's midwest district, Darrell R. Nordwall has been named manager of the company's east coast district and Charles H. Lovelace has been named manager of valve and fitting sales.

Lewis T. Barry, former Denver Equipment Co. employee, has joined the General Sales Dept. of Western Machinery Co., San Francisco, Calif.

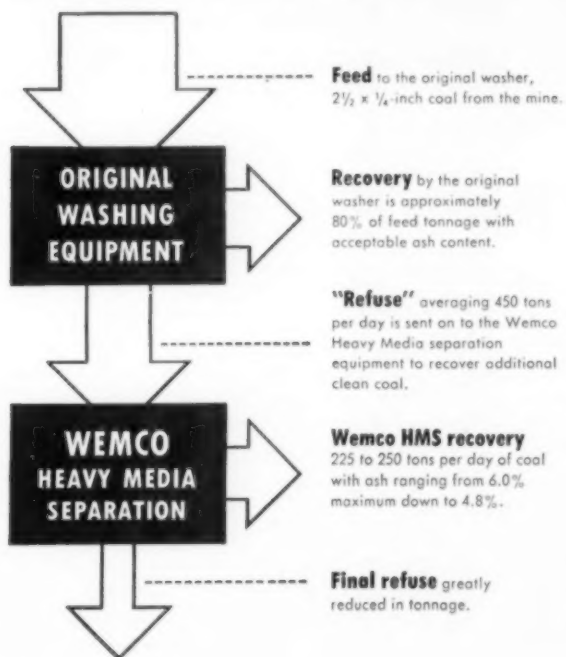
Atlas Powder Co. has announced the appointment of James L. Wetzel as manager of its eastern district explosives sales office, with headquarters in Wilmington, Del., the company's general offices. John K. O'Hare will succeed Mr. Wetzel as manager of the company's explosives sales office, Pittsburgh.

(Continued p 166)



WEMCO Heavy Media Separation RECOVERS UP TO 70% OF THIS PLANT'S WASHER REFUSE as Clean Coal

The Jewell Ridge story at a glance



"We are now recovering 225 to 250 tons per day of clean coal that was formerly lost," says the Division Engineer at Jewell Ridge Coal Company in Tilford, Kentucky.

Lab analysis at Jewell Ridge had shown a large loss of coal in the refuse of the original washing plant. A Wemco Heavy Media plant (of Mobil-Mill design) was added to treat the large volume of refuse. It was expected to recover a coal of 11 percent ash, saleable at a low price. But in actual operation, the Wemco Heavy Media equipment has been recovering 225 to 250 tons per day of coal in a range from 4.8% ash to 6.0% maximum. (Jewell Ridge Coal Company has now ordered a second Wemco Heavy Media plant.)

**A Wemco HMS Mobil-Mill
can earn extra profits on your mine too.
Write today for full information.**



760-G Folsom Street • San Francisco 7, California
Representatives throughout the United States and Canada
and in major countries around the world.



ROCKBESTOS AVC®

Goodman Boring Type
Continuous Mining Machine

KEEPS MAINTENANCE DOWN ON THIS CONTINUOUS MINER THAT KEEPS TONNAGE UP

To get top performance with minimum down time leading mining machinery manufacturers specify and use Rockbestos A.V.C.

For example, take the continuous miner manufactured by Goodman Manufacturing Company, illustrated. This high tonnage-producing machine cuts and loads up to 8 tons per minute.

With schedules geared to this kind of production — users can't afford wire failures. That's why Goodman uses Rockbestos A.V.C. for internal wiring in motors, in controllers and between controllers and resistors.

Goodman also uses Rockbestos in loaders, cutters, shuttle cars and locomotives.

You, too, can wire-in dependable performance by using Rockbestos A.V.C. High temperatures won't dry out or crack the insulation. And it won't bloom or rot when exposed to grease or oil. It fits bushings right, too.

When buying new equipment or rewiring old machines, specify and use Rockbestos A.V.C.

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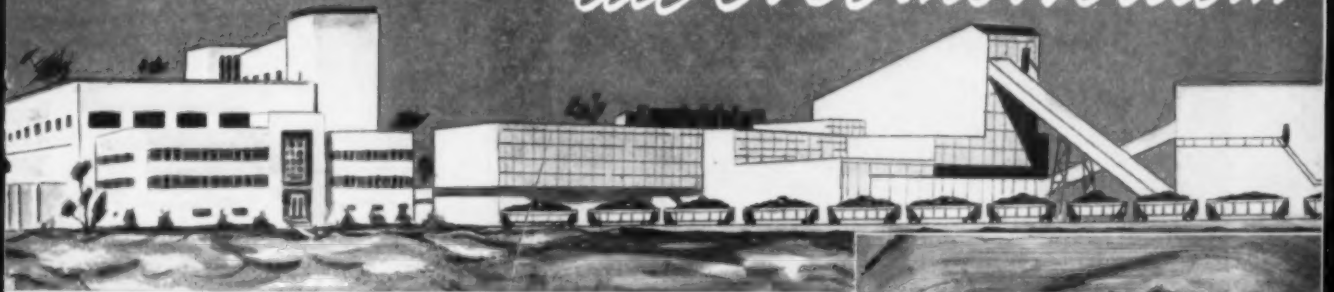


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BIRMINGHAM, ALA.
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BLUEFIELD, W. VA.
Superior-Sterling Co.
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Westinghouse Electric Supply Co.
COWEN, W. VA.
Pennsylvania & W. Virginia Supply Corp.
ELM GROVE, W. VA.
Pennsylvania & W. Virginia Supply Corp.
EVANSVILLE, IND.
Evansville Electric & Manufacturing Co.
FAIRMONT, W. VA.
Fairmont Supply Co.
GREENSBURG, PA.
Westmoreland Hardware Co.
HARLAN, KY.
Kentucky Mine & Supply Co., Inc.
HUNTINGTON, W. VA.
Banks-Miller Supply Co.
INDIANA, PA.
National Mine Service Co.
JENKINS, KY.
National Mine Service Co.
LOGAN, W. VA.
National Mine Service Co.
LOTHAIR, KY.
Mine Service Co.
McCLURE, VA.
Erwin Supply & Hardware Co., Inc.
MIDDLESBORO, KY.
Rogan & Rogan Co.
MORGANTOWN, W. VA.
Pennsylvania & W. Virginia Supply Corp.
PITTSBURGH, PA.
Westinghouse Electric Supply Co.
SCRANTON, PA.
Pennsylvania Electric Engineering Co.
WHEELING, W. VA.
Westinghouse Electric Supply Co.
WASHINGTON, PA.
Fairmont Supply Co.
WILLIAMSON, W. VA.
Williamson Supply Co.



Modern Mechanized Mines All Over the World...



**BREAK PRODUCTION RECORDS WITH
CINCINNATI'S* COMPLETE
LINE OF CHAINS AND BITS FOR EVERY
TYPE OF CONTINUOUS MINING MACHINE**



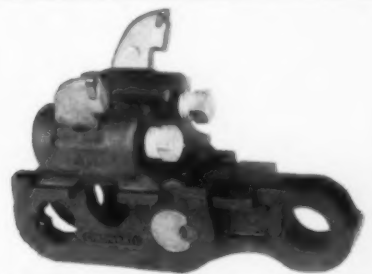
Interior illustration of highly mechanized operation where Continuous Miners and Cincinnati Chains and Bits are a "Must"!



TYPE-1854 . . . used on Joy Continuous Mining Machines where Ranges are required . . . either the 5 chain Ripper Head or the 2 chain Rotary Head.



STANDARD KERF TRIMMING CHAIN . . . for use on boring type Continuous Miner.



TYPE-1854-WF . . . used on Joy Continuous Mining Machines where flanges are NOT required . . . either the 5 chain Ripper Head or the 2 chain Rotary Head.

Always looking ahead, CINCINNATI MINE not only offers a complete line of chains and bits for every type of CONTINUOUS MINING MACHINE in use but has designed chains and bits for new machines now in the development and testing stage. Keeping ahead of the field is nothing new to the men at CINCINNATI MINE who have devoted the greater part of their lifetime to specializing in the design and manufacture of the BEST IN CHAINS AND BITS for every type of machine and for every individual cutting problem. Our leadership is not only the result of our own HIGHLY SKILLED PERSONNEL but also due to the fine co-operation our research staff and field men have had from our many friends in the industry. If at any time you have a cutting problem, we welcome the opportunity to be of assistance.

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MINE MACHINERY CO.
CINCINNATI 25, OHIO



tough enough to stand the daily grind...

Even under the toughest conditions, Collyer Portable Mining Cables assure maximum on-the-job power protection. Their dense, lead-cured neoprene jackets resist cutting, tearing and abrasion . . . protect against heat, moisture, oils, chemicals, sunlight and flames. Prove it for yourself. Send for samples and complete technical data today, and let us quote on your standard or special cable requirements.

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COLLYER INSULATED WIRE CO. • 245 Roosevelt Avenue, Pawtucket, R. I.

Manufacturers (Continued)

Joy Mfg. Co., Pittsburgh, Pa., has appointed William Hanson, Jr. its manager of conveyor products at its Philadelphia plant. Mr. Hanson joined Joy in 1951 as a designer, later moved to assistant manager of conveyor products.

J. C. Baseheart has been appointed engine sales manager and F. M. Borwell, assistant engine sales manager, according to officials of the Buda Div., Tractor Group, Allis-Chalmers Mfg. Co. Both men will work at the company's home office in Milwaukee, Wis.

D-A Lubricant Co., Inc., Indianapolis, Ind., has announced the appointment of Richard W. Burnett as field representative covering eastern Missouri.

Two July appointments have been announced by Newcomer Products, Inc., Latrobe, Pa. Austin Redmon has been named mining sales engineer in eastern Kentucky and Tennessee with headquarters at Middlesboro, Ky. Edward Yerkovich has been appointed mining service engineer with headquarters in Worthington, W. Va. He will service mines in northern West Virginia fields.

Fred E. Rau has been appointed manager, Hoisting Equipment Sales for the Yale Materials Handling Div., Yale & Towne Manufacturing Co., Philadelphia, Pa.

Dodge Mfg. Corp., Mishawaka, Ind., has announced these personnel changes: Carl W. Petersen, former vice president and works manager, elected executive vice president; Earl Wedlake, former production manager, elected vice president in charge of production and purchasing; Karl D. Jahnke, former assistant treasurer, promoted to secretary and treasurer to succeed the retired Temple Williams.

American Hoist and Derrick Co., St. Paul, Minn., has appointed Percy S. Gough, sales manager of the Crosby-Laughlin Div. Mr. Gough will be responsible for merchandising drop forged fittings for wire rope and chain. He joined American Hoist in 1937 and was manager of distribution before the appointment.

Jerry W. Hillebrand is the new district manager in St. Louis, Mo., area for the Industrial Rubber Div., Thermoid Co., Trenton, N.J. Mr. Hillebrand joined Thermoid in 1955 after 17 yr of selling with the Pioneer Rubber Mills. In another Thermoid appointment, Roy L. Wana-maker was named to cover the Denver, Salt Lake City area for the company.

Nelson L. Davis Co., Chicago engineering and contracting firm, is moving its engineering offices to McHenry, Ill. The company's general office will remain in Chicago.

This cab lets you TAKE IT EASY on tough jobs!

Modern features in new Chevrolet truck Flite-Ride cabs make your work easier and safer than ever before . . . give you the pleasure and prestige of style that equals many passenger cars!

Those numbers in the picture (right) point out features that make business almost a *pleasure* when you work behind the wheel of a modern Chevrolet Task-Force truck! Here are some of the reasons why hauling in a Chevy is *easy on you*:

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forward viewing area to make driving safer, easier. ❷ *Full-View rear window** adds to safe, convenient viewing as well as truck style.

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*Optional at extra cost.



They're the work champs of their class—with new V8's, automatic transmissions for every truck model!

You get modern power-performance in these Chevy medium-duty models! Compact short-stroke V8's do more work yet keep costs down. *Hydra-Matic* transmission† gives you no-shift hauling, reduced maintenance. And there's great *Powermatic*‡—the first automatic transmission designed specially for big trucks!

†Optional, extra cost, Series 3000-4000 models. ‡Optional, extra cost, Series 5000 through 10000 truck models.



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Anything less is an old-fashioned truck!

VOTE—but

DON'T VOTE IN THE DARK



**Study the issues and the candidates—
and then decide where you stand**

You wouldn't buy a new car without at least driving it around the block.

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So vote—but don't vote in the dark in this exciting election year.

Listen to what candidates are saying on TV and radio.

Read your newspapers—especially the politi-

cal news and editorial page.

Talk things out with your neighbors over the back fence and at the filling station on the corner. Take part in the discussion group at your church, club, lodge, or school.

Think about the issues and the candidates—and then make up your own mind. Remember, nobody is in that voting booth but you and your conscience. Step behind that curtain with pride on election day. Then vote as a free American.

VOTER'S CHECKLIST

1. Be sure you're registered.
2. Study the issues and candidates. Go to rallies. Ask questions. Read the papers. Listen to speeches.
3. Mark up a sample ballot in advance. (They are published in the papers.)
4. Join your neighbors at the polls on Election Day November 6th.



**Is your
name
in the
book?**

You can't vote if you're not registered. You lock yourself out of the polls, unless you're a registered voter. And you and only you can get your name in the Registration Book. When they call the roll on election day, will you be there? Do you know anyone who won't?



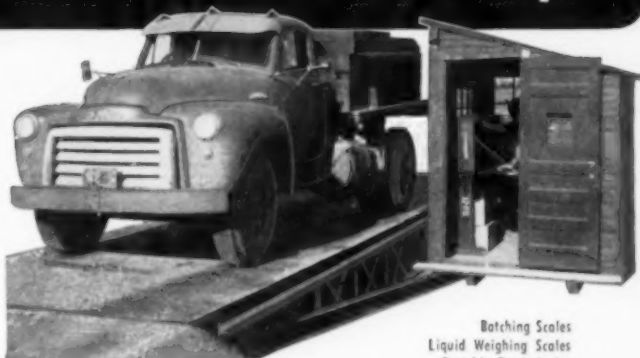
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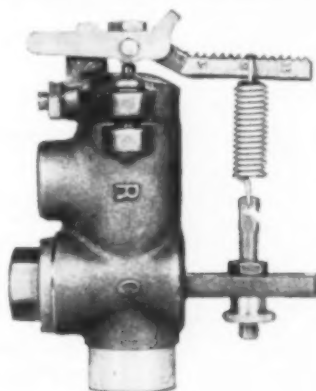
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coal, centrally located, large industrial area, 1½
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- 3—Joy 20-BU Loaders, latest type.
- 1—Joy 14-BU, low pedestal Loaders, 58-J Head Motors.
- 2—Joy 12-BU Loaders, 7E, excellent.
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- 3—Joy 11-BU Loaders.
- 6—Joy 8 SC Shuttle Cars, lowest type.
- 2—Joy 32E Shuttle Cars.
- 2—Joy 32E10 Shuttle Cars.
- 6—Joy 32E15 Shuttle Cars.
- 1—Joy T-1 Standard Cat Truck.
- 1—Joy T-2.5 Cat Truck, AC.
- 5—Joy T-2.5 Cat Trucks, 250 volt DC.
- 4—Joy 11-B Cutting Machines, like new.
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- 3—Goodman 600 Loaders on Cabs, excellent.
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- 1—Goodman 512 Cutting Machine with Bugduster, like new.
- 3—Jeffrey 29-UC Cutting Machines, cat mounted, perfect.

LOCOMOTIVES

- 2—Jeffrey 20 ton, type MM-110, 42" and 44" Ga.
- 4—Jeffrey 13 ton, MM-110, 36", 42" and 44" Ga.
- 3—Jeffrey 10 ton, type MM-78, 42" and 48" Ga.
- 12—Jeffrey 6 ton, type MM-88, 42", 44" and 48" Ga.
- 3—Jeffrey 4 ton, type MM-96, 42", 44" and 48" Ga.
- 1—G. E. 4 ton, type 825 Locomotives, 26" high.
- 10—G. E. 4 ton, types 801, 803, 821 Locomotives, 42", 44" and 48" Ga.
- 1—G. E. 8 ton, type 822 Locomotive, 44" Ga.
- 3—G. E. 10 ton, type 809 Locomotives, 42", 44" and 48" Ga.
- 1—G. E. 10 ton, 829 Locomotive, 36" Ga.
- 1—Goodman 4 ton, 8-30 Locomotive, 22" above rail.
- 8—Goodman type 33, 6 ton, 44" and 48" Ga.
- 2—Goodman 8 ton, type 32A, 44" and 48" Ga.
- 3—Westinghouse type 902, 4 ton, 42" and 48" Ga.
- 2—Westinghouse type 904, 6 ton, 44" and 48" Ga.
- 2—Westinghouse type 906, 44" and 48" Ga.
- 2—Westinghouse type 907, 10 ton, 44" and 48" Ga.

TIPPLE EQUIPMENT

- 1—Cedar Rapids portable super Screening Plant.
- 1—Railroad Car Unloading Conveyor, gas driven.
- 1—Allis Chalmers 5' x 14' Ripple Vibrator.
- 1—4' x 10' Robbins Gyrex Vibrator.
- 1—4' x 14' Vibrator, three deck, low head.
- Feeder, Drag Conveyors, and Loading Booms.

CUTTING MACHINES

- 3—Jeffrey 29UC Universal on cats.
- 4—Baby Goodman 212's, rebuilt.
- 3—Goodman 312's, 18" high.
- 3—Goodman 412's, 18" high.
- 1—Goodman 512's with Bugdusters, like new.
- 15—Goodman 12 AA's and 112 AA's.
- 10—Goodman 35A Stabbers.
- 2—Goodman 224 Stabbers.
- 3—Goodman 724 Stabbers.
- 30—Jeffrey 33L, like new, 17" high.
- 13—Jeffrey 35B's and 35B's.
- 2—Jeffrey 29B's on track.
- 1—Jeffrey 29L, track mounted.
- 2—Jeffrey 29C's, track mounted.
- 1—Jeffrey 29U, Universal, track mounted.
- 1—Sullivan CR-10, 15" high.

LOADING MACHINES

- 7—Joy Loaders, all types.
- 2—Jeffrey 61 CLR's on rubber, 26".
- 3—Jeffrey L-500 Loaders.
- 2—Goodman 360 Loaders.
- 3—Myers Whaley No. 3 Automatic Loaders.
- 3—Clarkson Loaders, 26" above Rail.

CONVEYORS

- 2—Joy 30" Belt Conveyors, 10 to 15 H.P.
- 2—Goodman 97-G's, 26".
- 3000' 30" Conveyor Belt.
- 8—Jeffrey 61AM Room Conveyors, 300 ft.
- 10—Jeffrey 61G Face Conveyors.
- 3—Room Conveyors, type 400, 300 ft.
- 2—61EW Elevating Conveyors.
- 2—61 WH, 15" Room Conveyors, 300 ft.
- 4—Joy Ladel UN-17 Shakers.
- 10—Goodman G-12's and G-15 Shakers.

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- 3—100 KW, G. E. TCC-6's, 275 volt Rotary Converters.
- 3—150 KW, G. E. MCC-6's, 275 volt Rotary Converters.
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- 3—300 KW, G. E. MCC-6 Rotary Converters, 275 DC.
- 1—200 KW Westinghouse Rotary Converter, 275 DC.
- 1—300 KW Westinghouse Rotary Converter, 275 DC.
- 1—300 KW Westinghouse Rotary Converter, 275 DC.
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- 300 Mine Cars, end dump, 20" high, 48" Ga.
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- 1—Card Rotary car dumper, 13' x 15' platform

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- 1—50 HP single drum
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- 9—G-20 Goodman shakers
- 6—G-15 Goodman shakers
- 6—Vulcan shakers
- 1—UN-17 Joy LaDel shaker
- 10—Goodman HA dockbills

MINING MACHINES

A.C.

- 1—7B Sullivan super shortwall
- 10—Sullivan CE7
- 1—28A Jeffrey
- 3—112A Goodman

D.C.

- 3—7B Sullivan super shortwall
- 2—T-1 Joy crawler type trucks

SCALES

- 3—100 ton Fairbanks railroad scales
- 1—125 ton Howe railroad scales

COAL CARS

- 80—66 cu. ft. Card steel, end dump, 36" ga.

SHUTTLE CARS

- 1—Joy model 60D3P, battery operated
- 7—Joy model 60D1, battery operated

MINE FANS

- 1—120" Joy La-Del axial flow fan, model L-14
- 1—8M Jeffrey 42" aerodyne fan
- 1—7" Jeffrey aerodyne 2 stage fan

BATTERY LOCOMOTIVES

- 1—4 ton Westinghouse, 24" ga.
- 1—4 ton Ironton, 36" ga.
- 2—5 ton General Electric, 36" ga.
- 2—7 ton General Electric, 36" ga.
- 1—8 ton Ironton, 36" ga.
- 2—8 ton General Electric, 36" ga.
- 2—8 ton Goodman, 36" ga.
- 1—10 ton Atlas, 36" ga.

TROLLEY LOCOMOTIVES

- 1—4½ T. Goodman, 36" ga.
- 1—3 T. Jeffrey, 36" ga.
- 1—6 T. Goodman, 36" ga.
- 1—6 T. Goodman, 42" ga.
- 2—8 T. Goodman, 42" ga.
- 3—10 T. Jeffrey, 42" ga.
- 1—13 T. Goodman, 42" ga.
- 1—13 T. Jeffrey, 42" ga.
- 3—13 T. Jeffrey, 42" ga.

MOTOR GENERATOR SETS

- 1—7 k.w. General Electric 125 V. DC—440 V. AC
- 148 k.w. Imperial 250 V. DC—440 V. AC
- 175 k.w. Lidgeway 125 V. DC—2380 V. AC

COAL CRUSHERS

- 1—18" x 18" Jeffrey Single Roll
- 1—30" x 30" Jeffrey Single Roll

ROCK DUSTERS

- 1—M.S.A. type A, 2 HP 250 V. DC motor
- 1—M.S.A. type A, 440 V. AC motor
- 1—M.S.A. #8-1183, 28 HP 230 V. DC motor

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EST. 1898

DENVER 1, COLO.

SEARCHLIGHT SECTION

CONVEYORS

- 1-24" Jeffrey Belt conveyor, approx. 60' long, with enough idler troughs and belt to increase length to 110' complete with 10 HP G.E. 220/440 volt ball bearing motor direct connected to Jeffrey class 61 speed reducer.
- 1-72" wide all steel apron type conveyor 30'8" centers, 33'9" overall length, 25" overall width.
- 1-48" Link Belt apron type loading boom, 25' long, complete with 15 HP Gen. Elec. 220 volt motor direct connected to Cleveland 361 speed reducer.
- 1-36" Feeder conveyor, 16' long, flights 2" x 2" 40. Overall dimensions, length 17'9", width 7'9", height 25".
- 1-36" Belt conveyor 150 ft. long, complete with Dings Magnetic head pulley, 15 HP 220 volt AC motor and speed reducer. New type Jeffrey ball bearing idlers.

COPPER CABLE

Approx. 7500 ft. 3/con. 2/0, 5000 volt trenching cable as good as new, wrapped on reels, 300-500 ft. long. Several 1000 ft. reels of 3/con. 2/0 armored lead covered 2300 volt cable.

CRUSHERS

- 1-Bradford Breaker, 9' in diameter, 17' long, 6" perf. screens, handled 750 tons per hour. New in 1950.
- 1-Bradford Breaker 12' in diameter, 22' long, 6" perf. screens.
- 1-18 x 18 Jeffrey single roll crusher.
- 1-18 x 18 McNally Pittsburgh double roll stoker crusher.
- 1-20 x 24 McNally Pittsburgh single roll.
- 1-24 x 48 McNally Pittsburgh double roll crusher, newest type, only used approx. 30 days, good as new with steel base and V belt drive.
- 1-24 x 36 McNally Pittsburgh double roll crusher.
- 1-24 x 12 McNally Pittsburgh single roll crusher, like new.
- 2-30 x 36 McNally Pittsburgh single roll crushers.

DRILLS

- 1-Dowley Bros. 580 Drill, model A10, 250 V DC, complete with Dowley 5000 drill arm mounted on rubber tired carriage. Self propelled with another 580 Dowley drill motor. Tires are 4.00-8. Overall height of drill from floor 36".

FANS

- 1-7" Joy Fan, type H-111-36, like brand new.
- 1-5" Jeffrey RH-60 Aerodyne Fan complete with 175 HP Westinghouse 2200 volt ball bearing motor and magnetic controller.
- 1-3" RH-36 Jeffrey Aerodyne Fan, excellent condition, complete with steel arch.

LOADING MACHINES

- 1-SBU Joy Loader, 220 volts, AC permissible, like new.
- 3-SBU Joy Loaders, 250 volts, DC, all ready to go to work.
- 1-12B Elmer Rucker Shovel 3 phase, 60 cycle, 220 volt. Purchased new a short time ago and used only a few weeks.

LOCOMOTIVES

- 1-16 ton Goodman ball bearing locomotive, type 20A-0-4-C, 42" gauge, overhauled and like new. Height 45", width 26", length 15", wheelbase 66".
- 5-15 ton Goodman ball bearing locomotives, type 36A-0-4-C, 42" ga. Overall length 14'7", height 46", width 5'8", wheelbase 5'6". Ready to go to work.
- 1-15 ton MHT7 Jeffrey ball bearing armature locomotive, 42" ga. Dimensions—length 16'8", width 5'1 1/2", wheelbase 6'4", height 42".
- 2-8 ton Jeffrey ball bearing journals and motors, 48" ga. type MHT5.
- 2-5 ton MHT8 Jeffrey ball bearing, 42" ga.
- 1-8 ton Goodman type 01K12-54T, 42" gauge, 27" high, new in 1950, used only 6 months.
- 12-4 ton Mancha Battery locomotives, 42" ga., 42" high overall.

ALL electric locomotives 250 volts, DC.

MINING MACHINES

- 6-7B-1 Sullivan, 250 volts, DC, 8 1/2" cutter bar, complete with bugdusters, permissible with Joy T1 Cat trucks.

- 1-512 E.H. Goodman 250 volt, DC, 8 1/2" cutter bar,

complete with bugduster. With or without Joy T1 truck.

- 1-512 E.H. Goodman 250 volt, DC, 8 1/2" cutter bar with or without Joy T1 truck.

GENERATOR SETS

- 4-200 KW Allis Chalmers motor generator sets, generator 250/275 volts, 723 amps, compound wound, 1200 RPM, direct connected to 300 HP Allis Chalmers syn. motor 3/60/2200 volts, 1200 RPM, complete with Clark completely auto. AC and DC enclosed control. Sets bought new in 1945 and used less than 1 year. Like brand new sets. Controls are portable and can be moved very easily, and ready to be hooked up to generator sets. All panels and MG Sets are identical and can be paralleled if necessary.
- 1-300 KW Ridgeway, 2300 volts, AC, end, 275 volts DC end, complete with switchboard as good as new.
- 1-200 KW Ridgeway, 2300 volts AC, 250 volts DC, 900 RPM.
- 2-200 KW G.E. sets, 1200 RPM, 2300 volts AC end, 250/275 volts DC end, complete with automatic circuit breaker, late type.
- 1-150 KW Westinghouse sets, 1200 RPM, 2300 volts, AC end, 250/275 volts DC end.
- 2-150 KW G.E. sets, 2300 volts AC end, 250/275 DC end, 1200 RPM.
- 2-100 KW Gen. Elec. MG Set, 250 volts DC, 2200 volts AC. Complete with manual switchboards.
- 1-100 KW Westinghouse, 990 RPM, AC end, 2200 volts, DC end, 250 volts. Manual Switchboard.
- 1-300 KW Allis Chalmers Rotary Converters, volts 185, amps 600, 6 phase, 60 cycles, 1200 RPM, DC, volts 250, amps 1200, complete with manual starting equipment and transformers as good as new, tested by a large electrical shop.
- 1-200 KW G.E. syn. Rotary Converter #408227, type HCC-6-200-1200, 1200 RPM, 60 cycle, 275 volts, 727 amps. Steel base complete with transformers, in perfect condition. As good as new.

SHUTTLE CARS

- 2-42E-18 Joy, electric, disc brakes, hydraulic steering. Late type, excellent condition.
- 2-42E-9 Joy, 250 volts, DC, stationary elevating discharge.

TRANSFORMERS

- 6-500 KVA Westinghouse single phase, 60 cycle, primary 23000, secondary 2300.
- 3-500 KVA General Electric, single phase, 60 cycle, primary 12500/6000, secondary 2300.
- 2-250 KVA Standard, single phase, 60 cycle, primary 23000, secondary 6900/11550V. Late type.
- 1-100 KVA Westinghouse, single phase, 60 cycle, primary 2300, secondary 220-440.
- 3-75 KVA Gregory Elec. Co., single phase, 60 cycle, 4000 volts to 2300 volts.
- 2-50 KVA Gregory Elec. Co., single phase, 60 cycle, primary 2400 volts, 120/240 secondary.

PUMPS

- 1-Fairbanks Morse centrifugal, 5" suction, 4" discharge, direct connected to 40 HP, 220-440 ball bearing motor rated 450 GPM at 150' head.
- 1-Fairbanks Morse centrifugal, 6" suction, 5" discharge, rated 1235 GPM at 150' head, direct connected to 100 HP Westinghouse 440 volt motor.
- 1-Dapton Dowd centrifugal, 4" suction, 4" discharge, rated 800 GPM at 190' head, direct connected to 50 HP G. E. 220-440 volt motor.

MINE CARS

- 120-5 ton all steel ACF drop bottom cars overall dimensions: Length 14', width 7', height from rail 42", wheelbase 48", gauge 36", 16" roller bearing wheels. These cars are like new. Can easily be changed to 42" gauge by purchasing two completely machined carbon axles, priced at \$15.00 each by ACF, and four cast iron spacers at \$1.65 each. For 48" ga. only additional cost would be the added weight of axle.

VIBRATORS

- 1-4' x 10' Selestro single deck vibrators, can be made two deck.
- 1-4' x 12' Delaster single deck vibrator.
- 1-4' x 10' Stephens-Adamson two deck vibrator.
- 3-5' x 14' Tyler T-600 double deck vibrators.
- 1-5' x 12' Tyler T-600 double deck vibrator.
- 2-4' x 8' Tyler T-600 single deck vibrators.
- 1-5' x 12' Tyler T-600 single deck vibrator.

GAVENDA BROTHERS, Inc., Canton, Ill.

PHONES: 739 and 2438

SHOVELS—DRAGLINES DRILLS CRANES—EUCLIDS

- 19-B Bucyrus Erie Elec. 8 yd. Shovel
- 170-B Bucyrus Erie Elec. 6 1/2 yd. Shovel
- 1600 P&H Elec. 6 yd. Shovel
- 2400 Lima 6 yd. Diesel Shovel
- 120-B Bucyrus Erie Elec. 5 yd. Shovel
- 1055 P&H 4 1/2 yd. Shovel
- 111-M Marion 4 yd. Shovel
- 1201 Lima Standard 3 1/2 yd. Shovel
- 111-M Marion 3 yd. High Lift Shovel
- 1201 Lima High Lift 2 1/2 yd. Shovel
- 803 Lima 2 1/2 yd. Shovel
- 80-D Northwest 2 1/2 yd. Shovel
- 955 P&H 2 1/2 yd. High Lift Shovel
- 54-B Bucyrus Erie 2 1/2 yd. Shovel
- 38-B Bucyrus Erie 1 1/2 yd. Shovel
- 6 Northwest 1 1/2 yd. Shovel
- 25 Northwest 3/4 yd. Shovel
- 22-B Bucyrus Erie 3/4 yd. Shovel
- 9-W Bucyrus Monighan Elec. Drag, 170', 13 yd.
- 360-M Marion Drag., 150' 10 yd.
- 625 Page diesel Drag, 150' 10 yd.
- 6160 Bucyrus Monighan Elec. Drag, 160', 8 yd.
- 200-W Bucyrus Monighan Drag, 140', 6 yd.
- 621 Page diesel Drag, 135', 6 yd.
- 2400 Lima Drag, 120' 6 yd.
- 5-W Bucyrus Monighan Drag, 120', 5 yd.
- 4500 Manitowoc Diesel Drag., 120', 5 yd.
- 4-W Bucyrus Monighan Drag, 110', 4 1/2 yd.
- 1201 Lima Dragline, 85', 3 1/2 yd.
- 1055 P&H Diesel Drag, 100', 3 yd.
- 3500 Manitowoc Diesel Drag, 80', 2 1/2 yd.
- 802 Lima Cranes
- 8-BH Joy Champion Rotary Air Drills
- 600 Reich Heavy Truck Mounted Rotary Air Drill
- Failing Rotary Drill
- Quarrymaster Drill—with 2-500 cu. ft. Compressors
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190—A.C.&F. All Steel, Stub Axle, 44" Ga., End Dump, 14" Dia. C.I. Timken Bearing Wheels, Bumper Height above rail 12 3/4", 10'-6" Inside Length, 6'-9 1/2" Wide, 28" Height above rail, 119.5 Cu. Ft. level full. Excellent Condition—Priced to Sell. Purchased New 1950.

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- (W) 2-38C Joy Shuttle Cars, late models
- (W) 1-35C ICF 500 Volt Joy Shuttle car
- (C) 2-32T Joy shuttle cars
- (W) 4-32D Joy shuttle cars
- (C) 1-Lee Norse Shuttle Car
- (C) 1-T-2 Joy Cat Trucks
- (C) 1-T-2-6 Joy Cat Truck—Like New
- (C) 1-T-2-3PG, 220/440 Volt AC Cat Truck
- (C) 1-14BU SPE Joy loaders
- (C) 1-12BU 500 Volt
- (C) 1-8BU As is or Rebuilt—500 Volt
- (C) 2-8BU As is or Rebuilt—250 Volt
- (W) 1-8BU 110, 220/440 Volt AC
- (W) 2-Baker battery supply tractors
- (C) 1-1224 Goodman Cutter—Rubber mounted
- (C) 1-683 Goodman Cat mounted loader
- (C) 1-368 Goodman Loader

- CONVEYORS**
- (W) 1-52B 26" Jeffrey Conveyor 900' center to center
- (W) 2-82A 24" Goodman conveyors, approx. 500'
- (C) 1-MTB 26" Joy Conveyor, 1000' centers, Less built
- (W) 11-61AM Jeffrey Room Chain Conveyors
- (W) 3-61MG Jeffrey Face Chain Conveyors
- (W) 5-61EW Jeffrey Elevating Chain Conveyors
- (W) 2-61W Jeffrey 15" gathering Chain conveyors
- (W) 4-15" Joy Chain conveyors, Permissible
- (W) 6-61S Goodman shaker units
- (W) 6-612½ Goodman shaker Conv.
- (W) 1-PT12 Long Piggyback Conv.

- CUTTING MACHINES**
- (W) 6-11B Sullivan, both 35 & 50 H.P.
- (W) 4-7AU Track mtd. Sullivan
- (W) 2-7B Sullivan, 220/440 Volt AC
- (W) 1-29C Jeffrey Arc Weld
- (W) 1-29U Jeffrey—Truck Mounted

- (C) 1-29U, 220/440 Volt AC—Excellent
- (C&W) 15-35B & 35BB Jeffrey, As is or Rebuilt
- (C) 1-35L Jeffrey
- (C&W) 6-12AB Standard Goodman, 35HP
- (C&W) 44-12AA Standard Goodman, 50 HP
- (C) 3-112 G3, 220/440 Volt AC Goodmans
- (W) 8-212AA Baby Goodmans
- (W) 3-1263, 220/440 Volt AC Goodmans
- (C) 2-412CA Goodmans
- (W) 4-512DA Goodmans
- (C) 2-712 Goodmans
- (C) 1-824 Goodman, 42" t.g.
- (C) 1-1224 Goodman — Rubber Mtd. Machine trucks for 12AA, 112AA, 212AA, & 35B

- LOCOMOTIVES**
- (W) 1-MH12 Jeffrey, 44" or 42" t.g.
- (W) 2-MH100 Jeffrey, 36" t.g.
- (C) 1-MH110 Jeffrey, 42" t.g.
- (W) 1-MH803 GE, 36", 42", or 44" t.g.
- (W) 1-HM809 GE, 44" t.g., 13 ton
- (W) 1-HM822 GE, 42" t.g.
- (W) 1-HM823 GE, 44" t.g.
- (W) 1-HM830 GE, 44" t.g.
- (W) 1-6-30 Goodman, 4 ton, 25" high, any t.g.
- (C&W) 3-331-T Goodman, 6 ton
- (W) 1-6 ton Goodman
- (W) 1-GE Battery locomotive, 42" t.g.—Locomotive & batteries are new

- MINE CARS**
- (W) 50-36" t.g., ACF Drop Bottom, cheap
- (W) 33-36" t.g., Sanford Day, Drop Bottom
- (C) 20-42" t.g., End Dump—Wood
- (W) 75-44" t.g., End Dump—2½ ton composite cars
- (W) 50-44" t.g., End Dump—3 ton Enterprise, all steel, excellent
- (W) 65-44" t.g., E.D., 2 ton Enterprise—Composite
- (W) 160-44" t.g., E.D., 1½ ton, 23" high, Composite

- SUBSTATIONS**
- (W) 1-300KW Mercury Arc Rectifier, 275 V DC, 2300/4000 Volt AC, completely automatic—Like New
- (W) 1-200KW, HCCS, GE Rotary, 1200 RPM, 275 V DC, 2300/4000 Volt transformers, automatic breakers
- (W) 2-200KW West. Rotary, 1200RPM, 2300/4000 Volt AC, 275 V DC, automatic breakers
- (W) 1-130KW HCCS, GE Rotary, 1200 RPM, 2300/4000 Volt—Automatic Breaker
- (W) 1-150KW West. MG Set, 1200RPM, 2200 Volt, 275 DC
- (W) 1-150KW GE, MG Set, 1200RPM, 2200 Volt, 275 DC

- MISCELLANEOUS**
- (W) 1-S track, all steel tippie, located at Insull, Kentucky
- (W) 600—Tons 23, 40, 56, 60 & 80 lb. Relaying Rail
- (W) 11—Tons 4, 6, 8, & 10 copper wire
- (C&W) 15—HKL Brown Favro Car Spotting Hoist
- (C) 1-Nolan Automatic Car Spotter
- (C&W) 12—Hoist—5 to 1000 H.P.
- (W) 2—Sets Mine track scales
- (W) 1-MSA Bushman duster—permissible
- (W) 1-Track Mtd. high pressure duster
- (W) 1-Sullivan Air Compressor
- (W) 2-Crossover dumps—New & Used
- (W) 10-272 CP Coal Drills
- (W) 1-Trolley phone system
- (W) 1-Truck bed for stoker coal—New
- (W) 1-Armco prefab steel building—130' long
- (W) 1-Morrow shaker
- (C) 1-42" Loading boom
- (C) 1-48" Loading Boom
- (W) 1-Lot 18' bell conveyor for 30' to 150'
- (C) 1-40" Morrow scraper conveyor 230' long

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- 150 KW. GE. 275 V.-2300/440 V.
- 150 KW. GE. 550 V.-2300/440 V.
- 100 KW. Westing. 275 V.-2300/440/220 V.
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- 2-20-ton Jeffrey MH-77. Practically new.
- 4-15-ton Jeffrey MH-77.
- 15-ton Jeffrey MH-110.
- 2-15-ton Goodman 36A-94C.
- 1-13-ton Goodman 36B-94C.
- 1-10-ton Goodman 34B-94C.
- 1-10-ton Jeffrey MH-143.
- 1-10-ton Westinghouse 927-LD.
- 2-8-ton Goodman 32-04T.
- 2-8-ton Very late type Jeffrey MH-100, permissible type, Timken roller bearing axles and journals, controller controls, Serial Nos. 7917-7918, 42" gauge.
- ATI 250 V DC, track gauges from 36" to 56½", completely rebuilt.

SUBSTATIONS

- 3-300 KW G.E. Rotary Converters, Type HCC-6, Form P, 1200, 250/275 V, complete with switchboards, switchgear, 1600 amp, I-T-E automatic reclosing circuit breakers.
- 3-200 KW G.E. Rotary Converters, Type HCC-6, Form P, 1200, 250/275 V, complete with switchboards, switchgear, 1200 amp, I-T-E automatic reclosing circuit breakers.
- Above Converters all equipped with three single phase, 60 cycle transformers, 2300/4000 V AC.
- 3-300 KW Westinghouse M.G. Sets, 250/275 V, 3 phase, 60 cycle, 2300 V, 1200 speed, complete with switchboards and all necessary switchgear.
- 2-200 KW G.E. M.G. Sets, 250/275 V, 1200, 2300 V AC, complete with switchboards and all necessary switchgear.

All types of loading and cutting machines, shuttle cars, steel mine cars, all gauges; 4- and 5-track steel tipples, single and double drum hoists for all purposes.

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NEW SPEED AND DRILLING ECONOMY

Parmanco

Model S1-S5 Dual
COAL DRILL



TWO DRILLS IN ONE

"It's a life saver to us"

says W. V. Hartman, Supt. Victoria Coal Corp.

Working ahead of an 8-yard loading shovel in 4-ft. coal, speed is essential.

Traction, hydraulic and electrical system operated by 109 hp engine. Push button controls. Drills can be operated singly or in tandem.

CUTTINGS SHIELD and GUIDE

—completely automatic

Blast holes, as seen in the picture, are kept clean from cuttings dropping back down the hole. A dam is formed about each blast hole excluding casual surface water.

SEND FOR COMPLETE DETAILS

PARIS MANUFACTURING CO.
PARIS, ILLINOIS

GUNDLACH CRUSHERS

ACCURATE SIZING...
ECONOMICALLY

What makes a crusher crush *ECONOMICALLY*?

ADJUSTMENT ASSEMBLY

Upper and lower rolls can be adjusted by a turn of hand wheel while Crusher is in operation. This easy adjustment feature gives operator a definite control of top size of the crushed product . . . between $\frac{3}{4}$ " and 6" top size.

GEAR BOX

The timing of the rolls on each stage is accomplished by means of this unique Gear Box, containing 2 drive gears and 2 idler gears, which are always in full mesh. All gears are steel, cut and hardened. Uses self-contained oil splash lubricating.

BEARINGS

The use of Timken opposed bearing units on roll shafts and precision ball bearings at other points keeps H.P. at an absolute minimum.

CRUSHER SHOWN WITH
HOPPER AND END PLATE REMOVED

UPPER ROLLS

Heavy one-piece cast steel construction. Striking sides and surfaces hard-faced with self-hardening rod give added life and decrease maintenance cost.

LOWER ROLLS

Heavy cast steel construction. Each tooth and striking surface hard-faced with self-hardening rod. Pocket-Tooth design gives a negligible percentage of oversize and a minimum of fines.

ALIGNMENT ASSEMBLY

Alignment Assembly, interlocked with adjustment feature, keeps rolls parallel at all times, even upon admission of tramp iron or non-crushable material.

SEE YOUR GUNDLACH REPRESENTATIVE
OR WRITE FOR INFORMATION

DIVISION OF J. M. J. INDUSTRIES

**T. J. GUNDLACH MACHINE CO. 226 CENTREVILLE
BELLEVILLE, ILL.**

HOW TO HAUL FAST IN SLOW GOING



Whether it's for contracting or strip mining, the application of the DW21 and No. 470 Scraper is the same. This CAT® DW21 (Series C) is the newest item of equipment on an all-Caterpillar operation. Widening a 13½-mile stretch of U.S. Highway No. 1 near Oak Hill, Fla., it is owned by White Construction Co., Inc., of Williston. The job involves moving half a million yd. of material. Fast loading and excellent flotation of the Caterpillar DW21 Tractor and No. 470 Scraper pay big dividends in this extremely soft going.

"This DW21 is a fine, fast-loading machine. Its big tires really help us in soft sand," says W. S. Perryman, job superintendent. In addition to the DW21, there are five DW10s, five Caterpillar track-type Tractors and a No. 12 Motor Grader working here.

The DW21's four-cycle, Turbocharged diesel engine develops 300 HP (maximum output)—ample for fast cycle times here and in mining applications. Wide-section 29.5-29 tires give maximum traction and big-footprint flotation on soft or sticky surfaces. They are tubeless tires, now standard equipment on the DW21, giving cooler running, better puncture and blowout

protection, easier servicing—and eliminating the major portion of down time caused by old-fashioned tires.

Teamed with the DW21 is the Caterpillar No. 470 Scraper, featuring LOWBOWL design for faster, bigger (25-yd. heaped capacity) payloads. Because the bowl is shallower, wider and longer, there is less resistance throughout the loading cycle. In on-the-job tests, the No. 470 Scraper actually proved to be 20% more efficient than the next-best scraper in its class!

Your Caterpillar Dealer will prove to you that this big yellow team can move more material in less time at lower cost on *your* job. See him today—and count on him for skilled service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**



“Now we wash **lumps** not **fines**—
it's a lot **cheaper** and **quicker**”

AIRDOX

NON-EXPLOSIVE MINING METHOD

Cuts Costs 5 Ways

- Produces less fines in face preparation
- Rolls coal forward for faster, easier loading
- Easier on “tender” roofs—cuts timbering, bolting
- Lowers cleaning costs by minimizing fines
- Reduces degradation—no shattered coal

The reason is simple—Airdox! The slow heaving action of Airdox gently dislodges coal from the working face, producing coarse coal rather than fines. When the coal reaches the cleaning plant, no bottleneck is created because coarse coal is much easier and quicker to wash than fines. This time-saving operation reduces cleaning costs and increases cleaning plant capacity. These advantages plus faster loading and less wear and maintenance on mechanical equipment, make Airdox the most economical method known for face preparation.

Get all the facts. Write for free survey.

CARDOX CORPORATION

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Benton, Illinois
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St. Clairsville, Ohio
Phone: St. Clairsville 619

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Phone: Boulder
Hillcrest 2-7298

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Box 427
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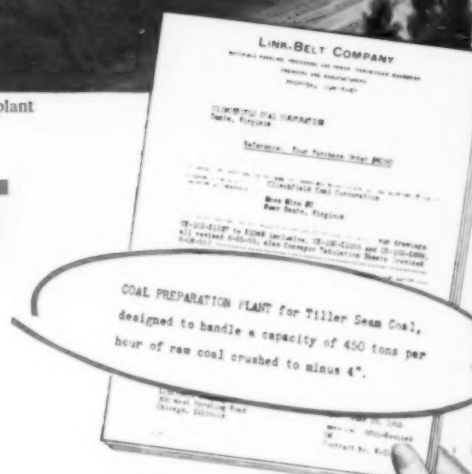
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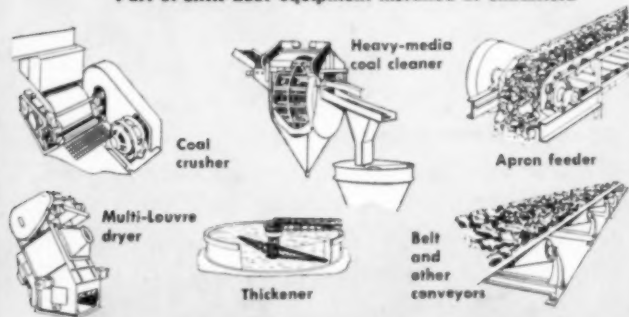
At right: Proposal contract delegating full responsibility for entire Clinchfield Coal Corp. plant to Link-Belt. Facility will service Moss Mine No. 2, Clinchfield, Virginia.

SINGLE CONTRACT

**awarded Link-Belt to build
complete Clinchfield plant**



Part of LINK-BELT equipment installed at Clinchfield



**LINK-BELT "turn-key" service
coordinates design, manufacture,
erection of preparation facilities**

THIS new coal preparation plant at Clinchfield, Va., is a working exhibit of Link-Belt "turn-key" service. Unequalled facilities enabled Link-Belt to accept full responsibility—from design to overall satisfactory performance. Here's how:

TESTING AND MANUFACTURE. Link-Belt laboratories analyze separation requirements . . . help develop practical procedures.

QUALITY EQUIPMENT. Link-Belt builds the broadest line—can recommend the right type equipment for any particular application.

OVERALL ENGINEERING. Vast experience of a nation-wide design and field engineering staff integrates all factors.

COMPLETE ERECTION. Experienced superintendents, staffs and skilled crews carry through entire job.

Like to put this "turn-key" service to work for you? Call your nearest Link-Belt office for an analysis of your needs.

LINK-BELT

COAL PREPARATION and HANDLING EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Birmingham 3, Cleveland 15, Denver 2, Detroit 4, Huntington 9, W. Va., Indianapolis 6, Kansas City 8, Mo., Louisville 2, Pittsburgh 13, Seattle 4, St. Louis 1, Scarboro (Toronto 13), Springs (South Africa).

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